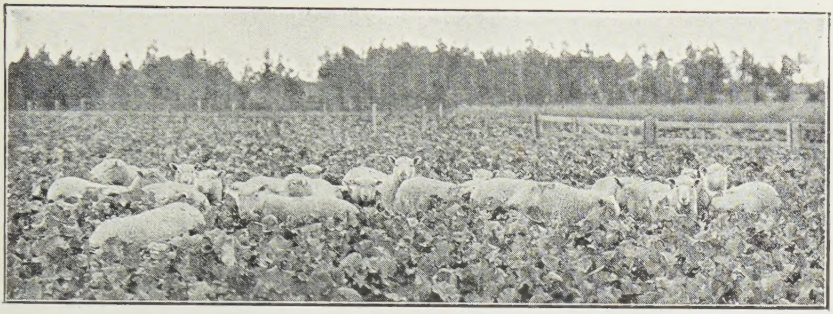

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SHELTER-BELTS AND HEDGES AT RUAKURA.

THE EXPERIENCE OF TWENTY YEARS.

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NOW that the Ruakura Farm of Instruction has been established for almost twenty years, it is possible to give some valuable information regarding the various shelter-belts and hedges planted during the early years of development. Fortunately, in the first place, the trees in these belts were well selected and planted in proper order, and since then have been well cared for. In every case wire fences protecting the trees from live-stock were erected, and have since been kept in sound repair. The planting and cutting-out later of nurse-trees is another factor which certainly has had a great influence over the present excellent state of these shelter-belts.

Those who have had experience in the growing of trees on wind-swept areas fully appreciate the value of quick-growing nurse-trees. They protect the slower-growing and more permanent trees from strong winds, draw them up straighter, and encourage more rapid growth. On the other hand, nurse-trees must not be allowed to remain too long in the shelters, and thinning-out is work which must be attended to at the right time. Many properly planted shelter-belts are ruined by allowing nurse-trees to remain too long. They

then overcrowd and finally kill the permanent trees, especially if such nurse-trees as pines are used. At Ruakura it has been found that *Pinus muricata* makes a most suitable nurse-tree in the shelter-belt. This pine is not so liable to overcrowd and will not rob the permanent trees to the same extent as *Pinus insignis*. Other trees thrive well when growing in close proximity to *Pinus muricata*, and it has remained very free from pests and diseases, which is an important matter. *Pinus halepensis* (Aleppo pine), *Pinus rigida* (American pitch-pine), and *Cryptomeria elegans* have been used to some extent, but in this district all have taken disease badly, and for this reason cannot be recommended. On poor lands *Pinus insignis* succeeds well as a nurse-tree, but care must be taken to cut it out immediately the permanent shelter-trees are sufficiently advanced to allow of thinning. It must be recognized that nurse-trees have other uses. They make good firewood, and at this station have been the main source of supply.

TREES AND SHRUBS WHICH HAVE GIVEN SATISFACTORY RESULTS.

At Ruakura the following trees have thriven and been found useful; they can be recommended for places with similar conditions:—

(1.) Trees suitable for a high single-row hedge: *Cupressus Lawsoniana* (Lawson's cypress), *Cupressus Benthamii*, *Cupressus Knightiana*, poplars and *Cupressus Lawsoniana* combined, poplars and *Pseudo-tsuga Douglasii* (Oregon pine) combined.

(2.) Trees suitable for a low single-row shelter hedge: (*a.*) Field hedges—*Berberis* (barberry), *Eleagnus japonica*, barberry and *Eleagnus* mixed, *Cupressus Lawsoniana* (well clipped). (*b.*) Garden or section hedges—*Juniperus communis hibernica* (Irish juniper), *Ligustrum sinensis* (Chinese privet), *Pittosporum Ralphii*, *Pittosporum tenuifolium*, *Cupressus Lawsoniana* (well clipped), *Podocarpus totara* (totara), (well clipped).

(3.) Trees suitable for mixed ornamental and shelter belts, planted three or four rows deep: (*a.*) Evergreen trees—*Cupressus macrocarpa*, *Cupressus Lawsoniana*, *Cupressus Benthamii*, *Sequoia sempervirens* (Californian redwood), *Wellingtonia gigantea* (Californian mammoth-tree), *Thuya gigantea* (Oregon white-cedar), *Pseudo-tsuga Douglasii* (Oregon pine), *Quercus sempervirens* (evergreen oak), *Pinus strobus* (Weymouth pine). (*b.*) Deciduous trees—*Betula alba* (white-birch), *Larix europaea* (English larch), *Fraxinus excelsior* (English ash), *Quercus robur* (English oak), *Juglans regia* (English walnut), *Juglans Sieboldiana* (Japanese walnut).

(4.) Trees suitable for planting in belts or corners for posts: *Eucalyptus Macarthuri*, *Eucalyptus fastigata*.

(5.) Trees suitable for planting in blocks for timber: *Pinus insignis*, *Cupressus macrocarpa*, *Sequoia sempervirens*, *Eucalyptus Macarthuri*, *Eucalyptus fastigata*.

(6.) Shrubs and trees suitable for an ornamental shrubbery of native trees: *Griselinia littoralis*, *Pittosporum Buchananii*, *Pittosporum Ralphii*, *Pittosporum tenuifolium*, *Olearia furfuracea*, *Olearia nitida*, *Persoonia toro*, *Panax arboreum*, *Hoheria populnea*, *Sophoro tetraptera* (kowhai), *Cordyline australis* (cabbage-tree), *Phyllocladus trichomanoides* (tanekaha), *Dacrydium cupressinum* (rimu), *Podocarpus spicatus* (matai), *Podocarpus dacrydioides* (kahikatea), *Podocarpus totara* (totara).

FIG. 1. CUPRESSUS LAWSONIANA AT RUAKURA.

These trees, planted thirteen years ago, have been allowed to make unchecked growth.

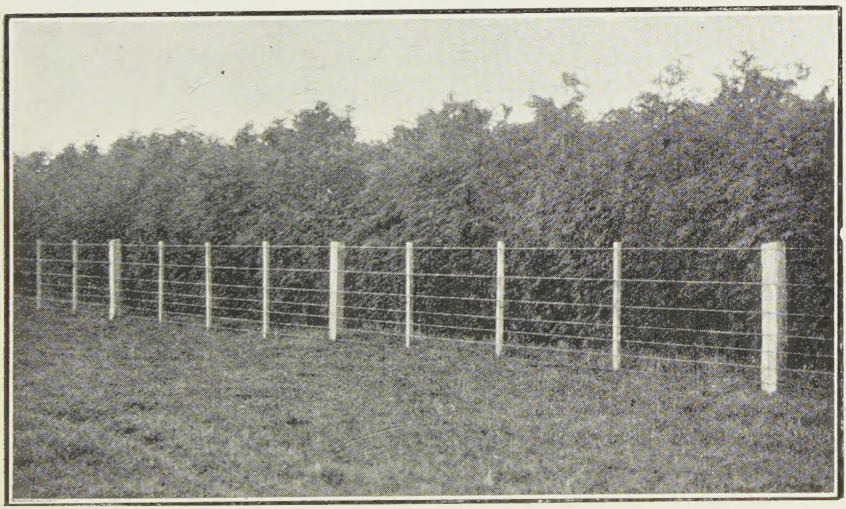


FIG. 2. HEDGE OF LAWSONIANA, RUAKURA.

Fourteen years old. Clipped yearly.

It may appear to many readers that numerous trees and shrubs have been omitted from these lists, but those enumerated have all been grown at Ruakura with satisfactory results.

NOT RECOMMENDED FOR RUAKURA CONDITIONS.

The following trees and shrubs cannot be recommended for planting on land and in positions similar to those at Ruakura :—

(1.) Attacked severely by pests and diseases : *Pinus halepensis* (Aleppo pine), *Pinus Sylvestris* (Scots pine), *Picea excelsa*, *Picea Menziesii*, *Cryptomeria elegans*, *Pittosporum eugenioides*, *Pittosporum crassifolium*, *Olearia Fosterii*, *Olearia Traversii*, *Viburnum Tinus* (laurestinus)

(2.) Killed or badly affected by frost : *Vitex littoralis* (puriri), *Corynocarpus laevigatus* (karaka), *Meryta Sinclairii* (puka), *Tecoma capensis*.

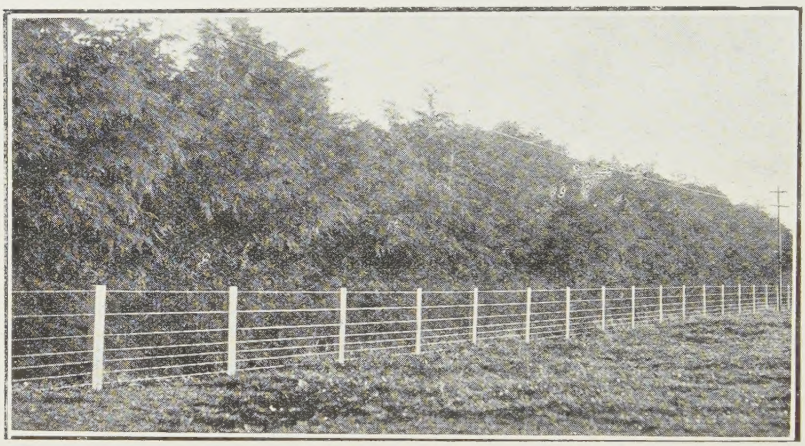


FIG. 3. CUPRESSUS BENTHAMII HEDGE, RUAKURA.

Eleven years old. Note the overhanging growth, affording shade as well as shelter.

SOME SPECIAL POINTS.

Attention may here be called to a few special points of interest in connection with the Ruakura plantings. It will be noticed that *Cupressus Lawsoniana* takes first place as an all-round ornamental and shelter tree. If allowed to grow unchecked it forms a high and beautiful tree, affording excellent shelter right to the ground, as shown in Fig. 1. If planted closer together in a single row and clipped once a year it forms an excellent dense wind-proof hedge (Fig. 2). The tree is easily raised from seed, readily transplanted, hardy and vigorous, fairly quick-growing, will succeed in a great variety of soils and situations, is practically free from pests and diseases, and is not palatable to live-stock. It has therefore many good qualities to commend it.

A splendid hedge of *Cupressus Benthamii*, eleven years old, is seen in Fig. 3. This variety of cypress had made heavier top growth than

Lawsoniana, and at a height of 9 ft. the branches overhang the protecting fences, thus affording valuable shade as well as shelter to live-stock.

Cupressus macrocarpa is omitted from the list of trees suitable for a high single-row shelter hedge. It must be admitted that in many instances it has been planted as a single-line hedge, but in most cases the results have been unsatisfactory. Such hedges are full of gaps, as trees of this species die out, not only when young, but at all stages of growth. Large heavy spreading branches are produced when the trees are planted in single lines, and, although useful for shade, bottom growth disappears as the trees grow old, and the value as a shelter hedge is lost. When planted for timber in blocks or wide belts the trees grow straight, producing useful trunks and few side branches.

Cryptomeria elegans is omitted as a shelter-tree, mainly on account of the lower branches dying and failing to give bottom shelter to a hedge or belt; it also harbours numerous pests and diseases.

Under the heading of a low single-row hedge it will be noted that barberry and *Eleagnus* mixed is recommended. When planted together in this manner it is found that a more even and dense hedge is formed than with one of barberry alone; and with the addition of barberry to the *Eleagnus* live-stock leave the hedge alone. *Eleagnus* has been omitted from the list of garden or section hedges, for in such positions it requires constant clipping and demands too much attention. It also harbours numerous garden pests and diseases.

Special reference is merited by *Pseudo-tsuga Douglasii* (Oregon pine). This tree has succeeded well at Ruakura in single-row hedges, in combination with poplars for a high breakwind, in deep plantations, and as a single specimen tree in the open. It is a tree which can be easily propagated and readily transplanted. The young trees produce masses of fibrous roots, and when properly wrenched they lift with excellent root-development. If planted with care and given a little attention the young trees will make rapid growth, and when once firmly established will soon form an excellent breakwind.

POINTS FOR INTENDING PLANTERS.

To inexperienced settlers intending to plant, this first and important advice is offered: (1) Select trees that will succeed in the class of soil and situation when planted; (2) select trees most suitable for the purpose for which they are to be planted; (3) select well-grown and well-rooted trees from nursery establishments when purchasing.

Remember that it is useless to plant a tender tree in an exposed position, a high-growing tree where only a shrub is required, or a slow-growing timber-tree when quick shelter is desired, and a complete waste of time to plant poorly rooted and badly raised trees. On the other hand, many excellent trees never thrive because they are badly planted and, when planted, completely neglected.

It is, of course, possible to group trees in order to combine ornament with shelter and shelter with timber. In most cases, however, when timber is the main object it will pay to confine the planting to timber alone, for in order to secure the best results in this direction trees of one class must be kept together and planted in deep breaks.

FIG. 4. ORNAMENTAL SHELTER-BELT AT RUAKURA, COMPOSED MAINLY OF BETULA ALBA (WHITE-BIRCH) AND CUPRESSUS LAWSONIANA.

FIG. 5. ANOTHER ORNAMENTAL SHELTER-BELT AT THE FARM, CONSISTING CHIEFLY OF BETULA ALBA (WHITE-BIRCH), PSEUDO-TSUGA DOUGLASII (OREGON PINE OR DOUGLAS FIR), SEQUOIA SEMPERVIRENS (CALIFORNIAN REDWOOD), AND PINUS STROBUS (WEYMOUTH PINE).

It is better, therefore, to plant waste corners or unploughable areas on a farm with timber-trees rather than endeavour to intersperse them in the hedges and smaller shelter-belts on the farm. In some cases the lay-out of the farm may allow of the planting of a heavy break of timber-trees along the boundary-fence against the prevailing wind, and this will provide excellent shelter as well.

CONCLUSION.

The value of ornamental and useful shelter hedges and trees round a homestead and on the farm cannot be overestimated. Beauty and use go hand-in-hand more frequently than we think, and the planting of trees will not involve a great increase in the cost of home-making. The cutting-out of so much native forest, particularly in the North Island, must have a marked influence over the country, and it is essential that more trees be planted. Without shelter it is impossible to bring in much of our waste and wind-swept areas.

No better demonstration could be given than that afforded by the Ruakura Farm. The 938 acres of original waste land, adjoining an area of 25,000 acres of open untouched swamp land, could not have reached its present high state of cultivation, with its excellent pastures carrying large herds of thriving sheep and cattle, had not shelter-trees been planted in the first instance. Combined with shelter is the beauty which these trees lend to the surroundings, and visitors from all parts of the world express delight at the beautiful lines of trees and hedges to be seen at this station.

A STANDARD WOOL-SHED FOR NEW ZEALAND CONDITIONS.

PLANS AND MATERIAL REQUIRED.

J. G. COOK, Wool Instructor, Live-stock Division.

In different parts of the Dominion the writer has frequently noted the necessity for a good standard wool-shed, designed to fully meet the requirements of the sheep-farmer while having due regard to economy. With these considerations in mind the accompanying plans have been prepared, together with a list of material required. The plans provide for a four-stand shearing-board, a capacity suitable for fair-sized flocks, but the size of the shed can be increased or decreased according to individual requirement.

When choosing a site for the wool-shed a piece of ground on the crest of a slope, having a long gradual rise from one side and a short steeper fall towards the other, should be selected if possible. With such a site the sheep-yards are constructed on the rising ground, this allowing rain-water to get away quickly and providing good drainage. On the highest part of the site is placed the end of the shed where the woolly sheep will enter, this portion being built on the short piles. The rest of the shed is built so as to extend out over the fall in the ground,

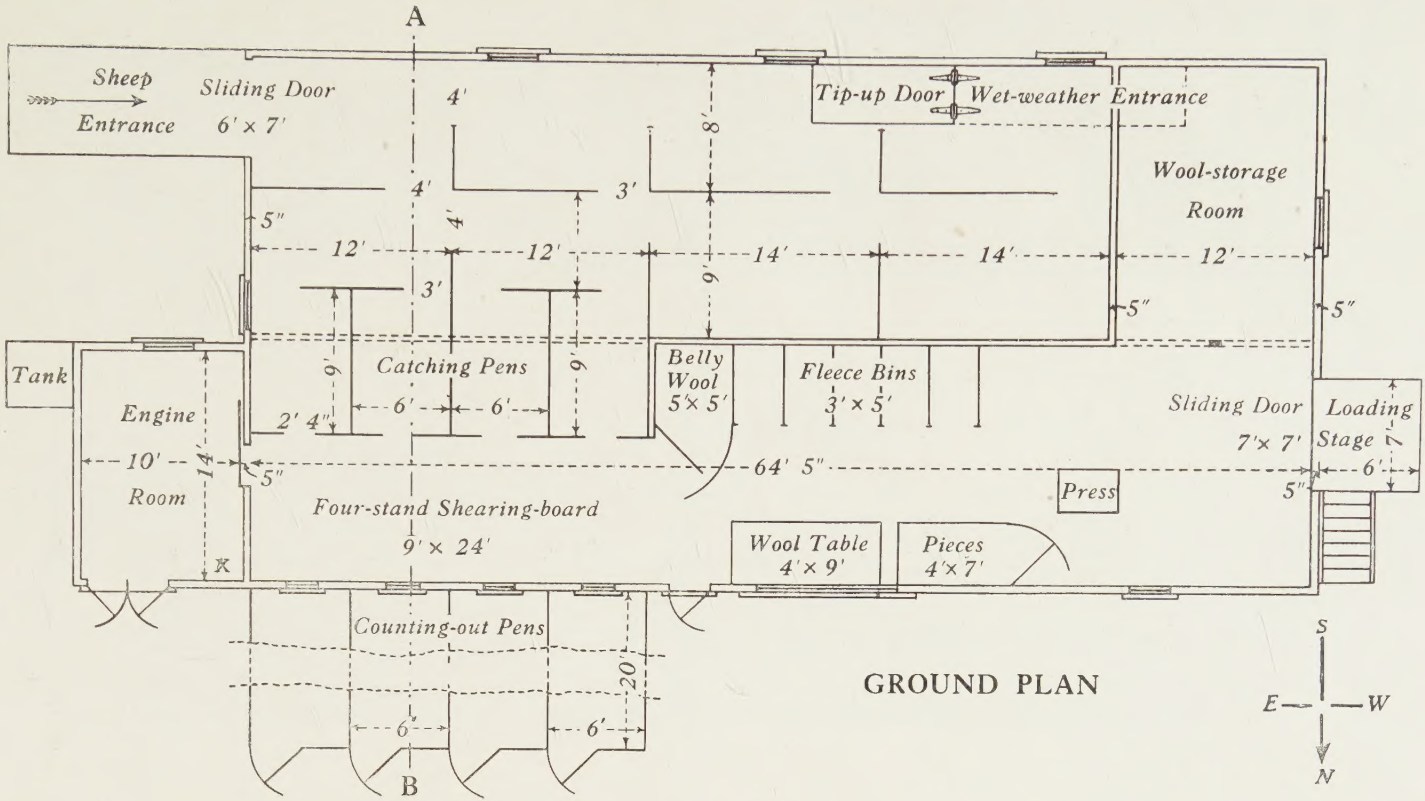
and rests on the longer piles. Placing the shed in this way serves a twofold purpose: (1) The height of the wool-room floor and loading-stage facilitates the loading of the wool wagons or lorries; and (2) the space under the wool-room floor may be used as a yard for holding woolly sheep, so as to give the shearers a fuller day's work in the event of broken weather occurring during shearing-time.

When making this yard under the wool-room floor the inner fence should be erected so that the yard does not extend under the grating forming the floor of the holding and catching pens. The yard is completed by wiring battens on the outside row of piles, leaving a door as shown. It is best to concrete this yard, as the bare ground would soon become contaminated with filth, and form a breeding-ground for disease. On the concrete floor gratings in sections should be put down. They are then easy to handle, and can be stacked up to allow the floor to be cleaned. A good bevel should be put on two sides of the battens forming the gratings, so that the bottom of each batten is narrower than the top. This allows manure to drop through readily, and keeps the surface of the gratings cleaner.

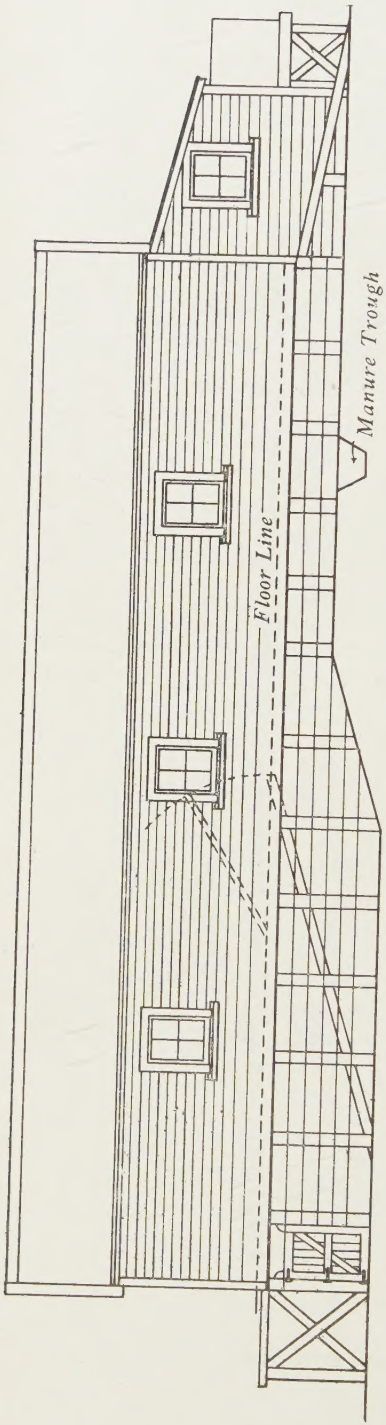
It is also advisable to concrete the counting-out pens, as these are then easily kept clean, so obviating the danger of an outbreak of blood-poisoning during shearing-time, which is always liable to happen when pens get into the foul condition inevitable with bare earth. The larger the number of sheep shorn, the greater is the danger of blood-poisoning, unless the pens are regularly cleaned out and either spread with lime or sprayed with a powerful disinfectant.

To bring the sheep from under the wool-room floor into the shed without taking them outside, a trap-door is cut in the grating of the inside holding-pens, as shown in the ground-plan, opening on to a battened race leading up from the lower yard, as shown in the south elevation. The dotted lines in the latter represent the trap-door raised to let the sheep come up. There is a small gate in the fence at the lower end of the race to keep out the sheep until required.

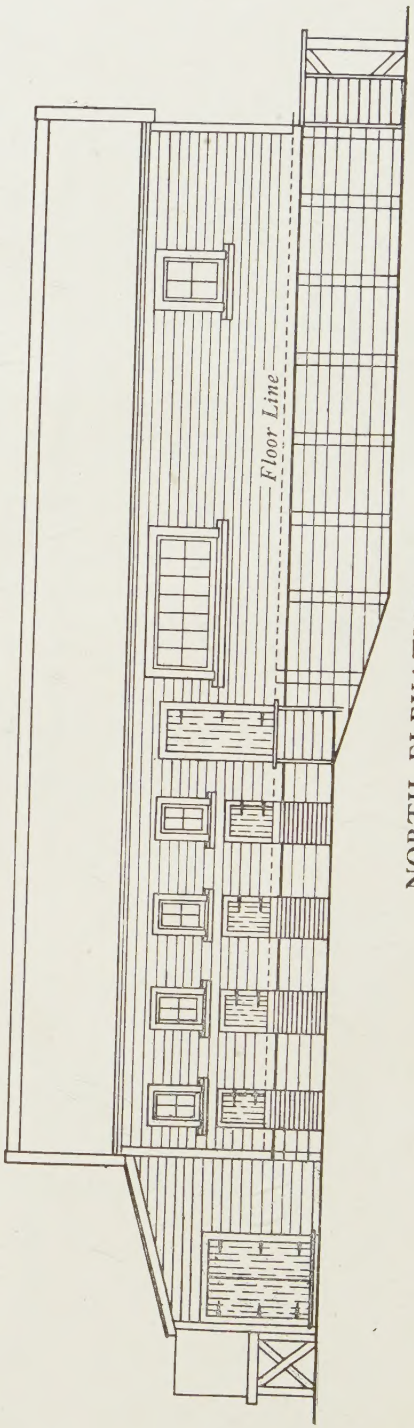
The shed shown in the plans is 32 ft. wide and 64 ft. 5 in. long, exclusive of the engine-room, which is 10 ft. by 14 ft.; but these measurements may be altered to suit requirements. The size of the wool-table should not be altered, unless to add length if the sheep are cutting big fleeces. A good bevel should be put on two sides of the battens forming the top of the wool-table, similarly to those of the gratings previously referred to. Any second cuts or other small pieces of wool which go between the battens will then immediately fall clear. If the battens are placed crosswise on the table greater strength is given than where they run from end to end. The wool-table can be fastened to the wall by strap hinges, and fixed so that the side next the wall will be somewhat higher than the outer side: a cant on the table makes the work easier. Instead of nailing the two legs on, it is better to bore an auger-hole through the table and legs and put a bolt through; or the legs may be strapped on with hinges; then after shearing-time it can be tipped up against the wall and tied, leaving the floor clear for other purposes. To keep the locks under the table two fairly wide boards are nailed on the inner side of the legs close to the lower end. Placing the boards on the inner side will make it more comfortable for the worker at the table by allowing more room for his feet.


A
Sheep
Entrance
Sliding Door
6′ × 7′
4′
4′
3′
8′
Tip-up Door
Wet-weather Entrance
Wool-storage
Room
5″
12′
12′
14′
14′
12′
4′
3′
9′
5″
5″
Tank
Engine
10′
Room
14′
9′
Catching Pens
9′
6′
6′
2′ 4″
Belly
Wool
5′ × 5′
Fleece Bins
3′ × 5′
Sliding Door
7′ × 7′
Loading
Stage
7′
6′
5″
64′ 5″
5″
Press
Four-stand Shearing-board
9′ × 24′
Wool Table
4′ × 9′
Pieces
4′ × 7′
K
Counting-out Pens
20′
6′
6′
B
S
E
W
N

GROUND PLAN

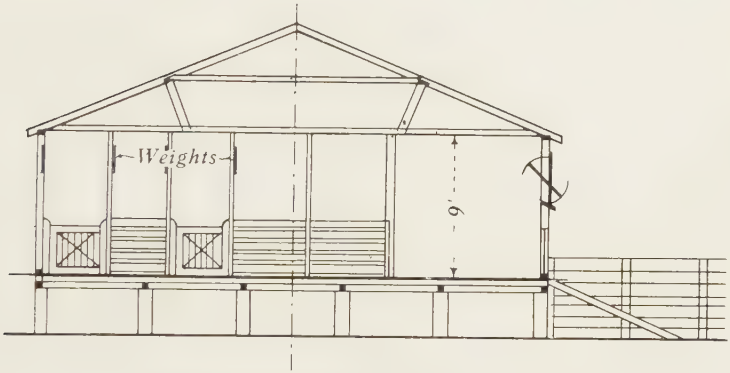


SOUTH ELEVATION

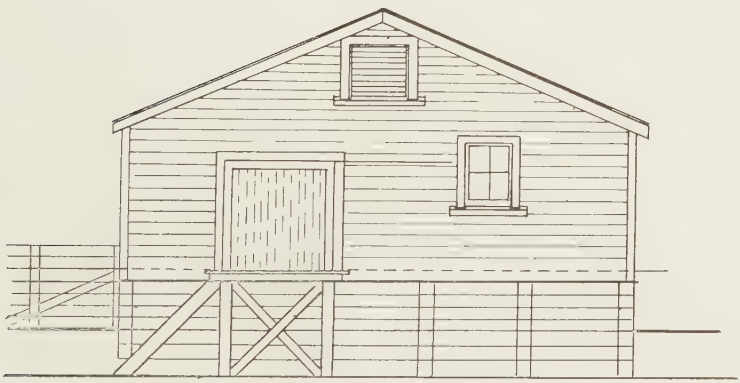


NORTH ELEVATION

EAST ELEVATION



SECTION ON A—B.



WEST ELEVATION

The door of the bin marked "Belly-wool" is 4 ft. by 5 ft., and is hung on strap hinges. In the bin marked "Pieces" the door is 4 ft. by 4 ft., and is also on strap hinges.

The wool-bins are 3 ft. wide, 5 ft. deep, and 7 ft. high, and this width and depth should not be altered. The tops of the bins may be boarded over, and the space above made use of at any time. The number of bins may be increased if necessary, and some used for pieces. All timber with which the wool comes in direct contact must be planed on one or both sides as required, this including the flooring-boards, the outer wall of the catching-pens, the back wall of the wool-bins, the partitions between the bins, and the whole of the wool-table. The studs of the shed are 9 ft. high, and on the shearing-board are of 4 in. by 3 in. timber. This is to give extra strength to that part of the wall where the machines are placed. The remainder of the studs are 4 in. by 2 in., and all corners are braced with 4 in. by 1 in. The dotted line in the ground-plan is for the centre beam, and an additional stud should be put in where the black square is shown.

The holding-pens in the shed can be altered to suit requirements, but should never be too large, because if the sheep get startled and crowd towards one end the whole pressure comes on to the animals against the rails at that end, and in a big pen these get badly bruised. The medium-sized pen will prevent serious results from this cause; there will also be less danger of smothering, especially at night-time. The plan shows single catching-pens—that is, one for each shearer. The reason for having these is that they do away with any cause of friction among the men; each shearer can suit himself whether he picks an easy shearing sheep or a more difficult subject. In the plan these pens are 6 ft. by 9 ft.

Slip-up gates with weights attached are the most convenient form, and, if desired, they may be made wider than is indicated in the plan. Those nearest the sheep entrance should be of a good width; the sheep will then enter better than if they had to come through narrow gates. The gates should never be placed in the middle of the side of a pen, as this makes it harder work to get the sheep through. In the plan they are put in the corner, so that the sheep come along a fence and go straight through the gateway. The height of the sheep-pens in the shed is 4 ft.

In the engine-room the grinding-wheel is situated at the point marked "X." The belt comes down off a pulley on the main overhead shafting, and should be near the wall at the end of the shearing-board.

Plenty of light is required in the shed, and the plan therefore shows six windows 3 ft. by 4 ft. in size, four 2 ft. by 3 ft. (one over each of the counting-out-pen doors), and a large window (4 ft. by 8 ft.) placed by the wool-table to enable the workers there to do their work thoroughly and expeditiously. A poor light at the table is a great handicap on clean, fast work. A couple of battens may be nailed across the lower part of each window in the sheep-pens in order to prevent breakage by the sheep.

The opening in each end of the shed shown as being louvred is so built that the louvres can be opened or closed as required. This enables the highest part of the shed to be thoroughly ventilated, especially during the night, which means a great difference in the state of the

air when work commences in the morning. As a further means of promoting good ventilation the sliding-door where the sheep enter the shed may be left open during fine weather, its place being taken by a hurdle which, after the shed has been filled, is put across the doorway and secured so that it cannot be shifted except by hand. At night as many doors, windows, and louvred ends should be left open as is consistent with safety, so as to allow a free passage of air through the shed to keep it cool and fresh.

In too many places it is found that the holding-room for woolly sheep is too small in proportion to the number of shearers on the board, so that in broken weather there is a good deal of time lost. By keeping the sheep close up to the shed, and making use of all available cover in the event of wet weather, the farmer can reduce to a minimum the time and money lost through wet weather.

A concrete manure-trough is provided as shown in the south elevation. This will be an incentive to clean out the manure from under the shed, thus keeping the ground floor clean and making the manure readily available for use in the garden, orchard, or elsewhere, instead of allowing it to go to waste and to poison the ground, as is too often the case.

Material required for Wool-shed shown in Plans.

Number.	Length.	Description.	Superficial Measurement.
	Ft.		Ft.
42	6	Piles	..
6	5	Piles	..
36	2½	Piles	..
12	19	Sleeper-plates, 4″ × 3″, V.D.L.	220
12	13	Sleeper-plates, 4″ × 3″, V.D.L.	156
80	16	Floor-joists, 5″ × 2″, 20″ centres	1,066
24	16	Wall-plates, 4″ × 2″	256
16	9	Studs, 4″ × 3″	144
102	9	Studs, 4″ × 2″	612
13	12	Studs, 4″ × 2″	104
12	16	Braces, 4″ × 1″	64
17	18	Ceiling-joists, 4″ × 2″	204
17	16	Ceiling-joists, 4″ × 2″	181
17	16	Collar-ties, 4″ × 1½″	156
17	10	Struts, 4″ × 1″	56
38	18	Rafters, 4″ × 2″	456
4	16	Ridge-boards, 4″ × 1¼″	56
32	16	Purlins, 3″ × 2″	256
8	16	Purlins, 4″ × 2″	85
4	10	Angle-stops, 3″ × 2″	20
8	20	Fascia-boards, 5″ × 1″	80
3	14	Door-facings, 4″ × 1″	14
2	16	Door-facings, 4″ × 1″	10
2	18	Door-facings, 4″ × 1″	12
..	..	Weatherboards, 8″ × ¾″	2,400
..	..	Flooring-boards, T. and G., 6″ × 1″ ..	1,150
67	10	Sheets, galvanized corrugated iron, 1½ lap ..	..
67	9	Sheets, galvanized corrugated iron, 1½ lap ..	..
9	8	Ridging-iron, 16″, or, if exposed to heavy wind, 18″, with lead tip	..
..	138	5″ spouting, with 3″ downpipe to lead on to roof of engine-room to allow water to run into tanks	..

Material, &c.—continued.

Number.	Length.	Description.	Superficial Measurement.
	Ft.		Ft.
1	..	Framed sliding-door, 7′ × 7′	..
1	..	Framed sliding-door, 6′ × 7′	..
1	..	Hinged ledge door 2½′ × 6½′	..
1	..	Ledge sliding-door, 2½′ × 6′	..
4	..	Counting-out-pen doors, 2′ × 2¾′	..
4	..	Catching-pen doors, 2′ 4″ × 4′	..
7	..	Windows, 3′ × 4′	..
4	..	Windows, 2′ × 3′, one at each shearer's stand	..
1	..	Window, 4′ × 8′, at wool-table	..
2	..	Louvred ends	..
		Sheep-pens in Shed.	
..	5,200 lin.	Battens, 2″ × 1″	870
..	440 lin.	Plates, 4″ × 2″	293
72	9	Studs, 4″ × 2″	432
4	12	Braces, solid, 4″ × 2″	32
..	650 lin.	Dressed division for pens, 5″ × 1″	..
..	..	Partition separating pens from shearing-board and back of wool-bins, 6″ × 1″	500
9	..	3′ × 4′ gates, with weights attached ..	..
5	..	4′ × 4′ gates, with weights attached ..	..
		Partitions for Wool-bins (Dressed Timber).	
6	7	Studs, 3″ × 2″, for front of partition ..	21
6	7	Studs, 2″ × 2″, for back of partition ..	14
18	5	Battens, 4″ × 1″, ledging for partitions ..	30
60	7	Battens, 6″ × 1″, partitions for bins ..	210
		Engine-room, 10 ft. × 14 ft.	
1	14	Sleeper-plate, 4″ × 3″, V.D.L.	14
1	10	Sleeper-plate, 4″ × 3″, V.D.L.	10
1	4	Sleeper-plate, 4″ × 3″, V.D.L.	4
2	10	Wall-plates, 4″ × 2″	13
1	14	Wall-plate, 4″ × 2″	9
14	12	Studs, 4″ × 2″	112
6	14	Studs, 4″ × 2″	56
2	12	Braces, solid, 4″ × 2″	16
4	14	Purlins, 3″ × 2″	28
6	10½	Rafters, 4″ × 2″	42
7	11	Sheets, galvanized corrugated iron, 1½ lap ..	..
1	14	5″ spouting, with downpipe to tank	..
..	..	Weatherboards, 8″ × ¾″	420
2	..	3′ × 8′ framed hinge doors	..
..	..	Concrete floor	..
..	..	Tank and stand (outside)	..
		Sheep-pen Gratings under Wool-room Floor.	
..	5,000 lin.	Battens, 2″ × 1″	833
..	400 lin.	Plates, 4″ × 2″	266

The total cost of doors, windows, gates, and louvred ends made at the factory is approximately £50. The estimated cost of the other materials listed, together with sundries such as nails, &c., is estimated at £275, Wellington prices in each case. The cost of materials for concreting floor of engine-room, sheep-pens, under shed, and the counting-out pens must be added.

COLLEGE ALGERIANS: A NEW STRAIN OF OATS.

THE plant-breeding work at Canterbury Agricultural College (Lincoln), which the Department of Agriculture has subsidized for the past three or four years, has resulted in the production this season of an improved strain of Algerian oats. Dr. F. W. Hilgendorf, Biologist to the College, contributes to the *Journal* the following outline history of the strain, which is designated as "A 86":—

1917.—In this year one hundred heads were selected from a commercial crop of Algerian oats, and the seed from each head was sown in a single row side by side in a bird-proof enclosure. Notes were made on the rapidity of growth of the various rows; the whole plot was fed off by a pet lamb three times (in May, June, and September), and the rapidity of recovery after feeding-off was noted. Strength and length of straw were observed, and all the hundred rows were threshed separately, and the quantity and quality of grain were measured. On all these points taken together ten strains were selected out of the hundred, and of these ten A 86 was one.

1918.—These ten strains were again sown in a bird-proof enclosure —each strain in a small plot about 10 yards by 1. They were again fed off (in April, June, and August), and again the tillering-capacity and recovery after feeding were noted. Each plot was threshed separately, and the notes regarding growth and yield allowed three to be selected out of the ten; of these three A 86 was one.

1919.—The three strains were sown in plots of about one-twentieth of an acre each, in an open field, and on each side of each strain was sown, under exactly the same conditions, the best commercial Algerian seed that could be bought in Christchurch. Strains and commercial plots were fed off twice, and the strains recovered slightly more rapidly that the check plots. The best tillering strain was A 86, and its yield was at the rate of 68 bushels per acre, as compared with 59 bushels from the commercial seed on each side of it. On the work of this year the three strains were reduced to two, of which A 86 was somewhat the better.

1920.—The two strains were each divided into two parts and sown on two half-acre plots, with commercial seed between and on each side of them. The resultant yield for the finally selected strain was as follows:—

Commercial	.. .. ..	49·6 bushels per acre.
A 86	.. .. ..	*60·8* ,,
Commercial	.. .. ..	53·5 ,,
A 86	.. .. ..	*59·1* ,,
Commercial	.. .. ..	41·2 ,,

1921.—Previous to this year the seed had been sown thinly —namely, at the rate of 1 bushel per acre—so as to make it go as far as possible, and this probably explains the somewhat low yields so far. It was obvious that A 86 was at an advantage in the

thin sowing because of its great tillering-power, so full seedings of 2 bushels per acre were now arranged for. The plots were each about an acre in extent, and the following yields were obtained :—

Commercial	76·4	bushels per acre.
A 86	*82·2*	,,
Commercial	74·3	,,
A 86	*77·5*	,,
Commercial	66·4	,,

1922.—The two strains so far retained had both proved superior to commercial seed, but there was some difficulty in determining which to finally keep. The two strains were therefore sown in the same field—about 18 acres of each—and a comparison made of their characters in their adjacent parts right across the field. The superior tillering-power of A 86 made it more resistant to the abnormal frosts of the winter of 1922, and it was decided that it was the better strain —a decision which was corroborated by the final yield.

As a result A 86 was finally selected, and is now on sale under the name of "College Algerians." The strain is characterized by high tillering-power, a creeping habit of growth, quick recovery after feeding-off, a high degree of uniformity during growth and ripening, good yielding-capacity, and a good and uniform grain-sample.

Unfortunately the seed has become contaminated with wild oats during recent years, owing to its being sown in a field where these pests were lying unsuspected in the soil. The College was therefore unable to handle the bulk of seed, and so it (together with the runner-up strain) has been handed to Wright, Stephenson, and Co., Christchurch, to clean as well as possible and to distribute. A few bushels have been hand-picked, and a start made to build up a new lot for distribution.*

It is to be noted that the good results from this strain were produced under Canterbury conditions, and there is therefore no certainty that they will be repeated in other climates—for example, that of the North Island.

Summary.

1917–18 : The strain A 86 was among the best out of 100 strains, regard being had to tillering, growth, recovery after feeding, and quantity and quality of grain.

1919–22 : A 86 averaged about 10 bushels per acre above commercial seed sown under the same conditions.

There is no guarantee of suitability to other climates, nor of absolute absence of wild oats from the 1923 sample.

*Since writing, a sack sample of the seed has been received from Messrs. Wright, Stephenson after dressing, and a fairly careful examination seems to show that the wild oats have been successfully removed.

Death Duty and Plantations.—The point has been raised lately as to whether plantations of trees established by farmers or other persons are subject to death duty. The State Forest Service points out that the statutory definition of "land" under the Death Duties Act, 1921, excludes "native bush or trees which have been planted for shelter or ornamental or utility purposes." The effect of this appears to make such plantations exempt from death duty.

THE POISONOUS, SUSPECTED, AND MEDICINAL PLANTS OF NEW ZEALAND.

(Continued.)

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

COMPOSITAE—*continued.*

BEFORE leaving the subject of the rangiora (*Brachyglottis rapanda*) some additional evidence as to the poisonous nature of this species may be given. Mr. D. Sinclair, of Terrace End, Palmerston North, wrote on 5th April, 1915, that he had a saddle-horse become tipsy, or almost unable to stand up, from having eaten some rangiora. From Mangamaire, Upper Wairarapa, a correspondent wrote on 22nd December, 1914, that he had just lost three cows, and the only thing that could possibly have hurt them was one rangiora-tree in full flower which the cows had been eating. Another cow in the same paddock was drunk from the same cause, and could only just walk. The owner stated that he had seen a horse affected in just the same way as was this cow after eating rangiora, but had never experienced having cattle poisoned by it before.

A Taihape farmer, in August, 1914, sent to this Laboratory the stomach-contents of a yearling heifer calf. He had lost two within a few weeks, although the stock were in good condition and had plenty of pasture and hay. The owner was at a loss as to the cause of the deaths, the symptoms being, according to his description, that the calves seemed to lie about as if sleepy, and then die without a struggle. There was, he added, a little tutu and rangiora growing on the place. Upon examination in the laboratory the stomach-contents were found to consist largely of fragments of the leaves of rangiora.

A Wanganui settler, in August, 1900, informed the writer that rangiora was most poisonous to horses in winter. He had known a few to die, but the majority recovered, the symptoms being staggering as if drunk, and swelling of the head and legs. Those which recovered were always "groggy on their pins" for a few weeks.

Mr. Elsdon Best, in September, 1900, reported from Ruatahuna that horses sometimes die of eating wharangi, blood-letting and violent exercise being the native cures. His own horse, shortly before writing, was "wharangied," and had to be taken for a three-mile sharp canter as a cure.

A correspondent on the Wanganui River, in February, 1906, wrote that rangiora is better known as the "paper-leaf," and that he had seen a good many horses drunk from eating it, but did not know of a single instance of a horse dying from it. In fact, the packhorses in many places lived and thrived on it, and got very fond of it. As soon as an affected animal was worked so as to get heated and to sweat, the effects wore off. This correspondent also related a case of poisoning by honey on 20th November, when the rangiora would be in flower. Three bushmen were poisoned, but gradually recovered. He stated that the Maoris never take the wild honey when the rangiora is in blossom.

Centipeda orbicularis (*Cotula minuta* Forst.), a small native weed usually found in swampy places in the North Island, is stated by Lauder Lindsay to be possessed, under certain circumstances, of pungent, irritant, or sternutatory properties, causing sneezing when bruised under the nose.

Celmisia sp. is the native "cotton-plant" or "horse-daisy" of the New Zealand mountains. In Otago one or more of the species is dried and smoked as tobacco. Neil (1889), ("N.Z. Herb Doctor," p. 495), states that it relieves asthma.

APOCYANACEAE.

A great many plants of this family are physiologically active, and some of them intensely poisonous. The New Zealand representatives are small climbing shrubs of the genus *Parsonsia*, with yellowish-white or pink flowers produced in great profusion. There are two species—*P. heterophylla* and *P. capsularis*. They probably contain saponins, and from the fact that they belong to such a poisonous family are worthy of chemical investigation.

GENTIANEAE.

The genus *Gentiana*, which includes the beautiful gentians of our New Zealand mountains, is remarkable for the bitter principle which every member contains. Possibly some of the larger species might be made to yield a gentian root or gentian bitter similar to the well-known imported tonic.

CONVOLVACEAE.

Calystegia sepium—the pohue of the Maori and the bindweed of the settler—is a widely spread weed, and one which in the Northern Hemisphere is undoubtedly poisonous. Long remarks that the two species *C. sepium* and *C. arvensis*, when eaten in considerable quantity, appear to be cathartic and purgative, causing symptoms similar to those due to jalap. Colenso ("Essay," p. 31) remarks that the roots of *C. sepium* were cooked and eaten by the Maoris. Lauder Lindsay remarks that the large tuberous rhizomes, although eaten by the Natives, are in Europe regarded as poisonous, and yield a resin resembling scammony, which is a general characteristic of the *Convolvaceae*, although there are marked exceptions, such as *C. batatas*, the sweet-potato. Dr. Hooker very justly remarked that the properties of the same species may vary eminently in various localities. This is notoriously the case in many medicinal plants which are of violent action in one climate and innocuous in another. It is not to be thought, however, that because the roots are edible when cooked by the Maori they are non-poisonous when raw.

SOLANACEAE.

This is a family containing many poisonous and many useful plants, but in New Zealand there are only two native representatives—*Solanum nigrum*, the "garden nightshade," and *S. aviculare*, the poroporo of the Maori. *S. nigrum* is widespread throughout the world. Cases of poisoning in stock, calves, sheep, goats, and pigs are recorded in other countries. Long remarks that though it must always be regarded as poisonous, the plant varies considerably in toxicity according to soil, climate, and general conditions of growth. The symptoms of poisoning

are apparently much the same in man and animals — stupefaction; staggering; loss of speech, feeling, and consciousness; cramps; and sometimes convulsions. The pupil is generally dilated. The writer has come across one case in New Zealand in which lambs confined to a paddock on which was a large aftermath growth of *S. nigrum* went off in condition and a number died.

SCROPHULARINEAE.

Veronica is the only New Zealand genus of this large family (which derives its name from the supposed virtues of some of its members in curing scrofula) of which anything can be said. There are many medicinal plants belonging to the family, perhaps the best known now being the *Digitalis* (foxglove), which will be discussed later in this series of articles.

The leaves of some of the hundred or so species of *Veronica*, or koromiko, which are so abundant throughout New Zealand, have a great reputation as a cure for diarrhœa, both among the settlers and the Natives. There is some doubt if the young leaves, which are the part used as a medicine, yield their virtue to the patient by any other means save that obtained through the chewing of the leaves. Dr. Bell (*N.Z. Medical Journal*, April, 1900, p. 135) notes that it is stated that when koromiko is prepared as a tincture or infusion it is not so effectual. Dr. Bell tried large doses of both these preparations without their having the slightest effect on diarrhœa. Neither did he notice any marked astringent effect in a fresh decoction. The leaves themselves are so easily obtained from bush or garden, where they are generally grown as ornamental shrubs, that there would seem to be no reason for making them into a preparation if the mere chewing of the leaves would accomplish the desired result. The leaves of all the species appear to have a similar astringent taste.

MYOPORINEAE.

Myoporum laetum—the ngaio, a common tree throughout New Zealand, especially in coastal situations—is undoubtedly a cattle-poison. Cases of poisoning usually occur in winter, when the grass is short and when branches of the ngaio or the trees themselves are blown down by gales. In the 1900 Annual Report of the Department of Agriculture, p. 127, the writer has recorded that the oil extracted from the leaves (by steam distillation) was non-toxic to guinea-pigs in 6 milligram doses.

The following are instances of poisoning of stock by ngaio which have come under the writer's notice. In May, 1910, the owner of thirty-five cows at Duvauchelle Bay, Banks Peninsula, found fourteen of them staggering about. Two died in twenty-four hours, and three more in another thirty-six hours. The owner opened one and found a dry solid mass of ngaio leaves and twigs in the rumen. The symptoms were compatible with death from acute constipation. A correspondent from Palmerston, Otago, in May, 1911, reported that several cows had died in the district from eating the leaves and fruit of the ngaio, the symptoms being extreme costiveness and severe pain. A typical case occurred in the Wairarapa in August, 1912, where a farmer lost five out of eighteen two- to three-year-old bullocks turned into a 40-acre

paddock about a week previously. The weather had been cold and stormy, and a very large ngaio-tree had been blown down. Three dead cattle were opened, and the small dark-green buds and leaves of the ngaio were found mixed with grass. Mr. Howard, Government Veterinarian, also visited the farm and reported on three of the dead animals, finding the stomachs filled with ngaio leaves, buds, and twigs, mixed with a small amount of dried grass. There is little doubt, he concluded, that the animals were poisoned as a result of eating their fill of ngaio-leaves when there was little or nothing else in their stomachs. Several farmers lost cows through ngaio poisoning at Moumahaki in May, 1918.

Goldie remarks of the use of the ngaio by the Maoris that the bark is chewed for toothache, the twigs and leaves to medicate the vapour bath, and the juice expressed from the leaves is applied to the skin to prevent mosquito and sandfly bites.

An allied species, *M. deserti* A. Cunn., the ellangowan poison-bush of Queensland, has caused, according to Bailey (1906), ("Weeds and Suspected Poisonous Plants of Queensland"), great losses to travelling flocks of sheep. Other species of this genus have been suspected of poisoning sheep.

VERBENACEAE.

Vitex littoralis is the puriri of the northern portion of the North Island, well known as a most useful hardwood tree, valuable for building-construction in which great strength and durability is required, and for fencing, sleepers, &c. Baber remarks that it may be classed among dangerous plants from the severe inflammation which may be caused by splinters penetrating the skin of hands and feet. The dyeing properties of the wood and the dyeing principles have been isolated and investigated by the well-known colour chemist, A. G. Perkin, F.R.S. (*Trans. Chem. Soc.*, 1898, Pt. 1, p. 1019).

PIPERACEAE.

Piper excelsum—the kawakawa of the Maori—is one of the commoner shrubs of the North Island and the northern part of the South Island. It is a plant which possesses, in common with other species of the *Piper* genus (which includes all the trees furnishing the pepper of commerce), the aromatic and stimulating properties which characterize them. The kawakawa of the Polynesian islands, so well known as furnishing an intoxicating drink which is there so ceremoniously consumed, is *Piper methysticum*.

Baber says that the effect of the New Zealand *Piper* is stimulating, exciting the salivary glands, the kidneys, and the bowels slightly. It is aphrodisiac. The fruit and seed, ripe or unripe, are much more powerful than the leaves, although the latter are generally used. An extract of the crushed leaves, made by pouring boiling water upon them and allowing it to cool, affords a pleasant drink when the taste is acquired. The writer has found this decoction an efficient remedy for the cure of boils, and has verified all the symptoms mentioned by Baber as following the use of the extract. Hochstetter remarks that an infusion of the leaves when brewed makes a very refreshing beer. Goldie states that this species does not possess the sedative and narcotic properties of kawakawa. It is used by the Maoris for

toothache, dysentery, and for various other medicinal purposes. Dr. Thompson ("Story of New Zealand") remarks that it is singular that New-Zealanders have forgotten the art of extracting an intoxicating beverage from kawa-root, seeing that the plant grows abundantly in the country. Lauder Lindsay, in his "Toot" paper, corrects Dr. Thompson in confusing *Piper methysticum* with *P. excelsum*, but quotes Dr. Dieffenbach (1843), ("Travels in New Zealand," Vol. 1, p. 426), in saying that its leaves form a good and apparently healthy substitute for tea. The active principles of both these species are well worth careful investigation.

MONIMIACEAE.

Laurelia Novae Zelandiae—the pukatea, a forest tree—is certainly one of the medicinal plants of New Zealand. Dr. Goldie states that the inner layer of the bark of this aromatic plant is boiled in water by the Maoris, and the decoction thus prepared is applied externally to tuberculous and chronic ulcers and various cutaneous diseases. A strong solution held in the mouth relieves odontalgia (toothache), and it is also taken internally and applied locally in syphilis. The present writer has isolated three alkaloids from the bark (*Trans. Chem. Soc.*, 1910, p. 1381). The physiological action of the principal alkaloid, puketeine, has been investigated by Professor Malcolm, Otago Medical School, who published in the Annual Report of the Department of Agriculture for 1908, p. 226, a short account of his research (which is being continued). The new alkaloid is like strychnine in its action, but very much milder: 0·3 gram per kilo caused convulsions in a rabbit when given by mouth, but the animal recovered; 0·25 gram given hypodermically caused death in a rabbit in half an hour.

The pukatea alkaloids exist in comparatively large quantities in the bark of the tree, amounts of the order of 1 or 2 per cent. of the weight of bark being present. There would therefore be no difficulty in obtaining sufficient of the alkaloid for a thorough investigation. It is noteworthy that two of the alkaloids differ in chemical formula by C_2H_4, puketeine being $C_{17}H_{17}NO_3$, and laureline $C_{19}H_{21}NO_3$. A more recent investigator, Pyman (1914), (*Trans. Chem. Soc.*, Vol. 105, p. 1679), working on an allied tree from Queensland (*Daphnandra micrantha*, family *Monimiaceae*), isolated alkaloids as follows: Daphnandrine, $C_{36}H_{38}N_2O_6$; daphnoline, $C_{34}H_{34}N_2O_6$; micranthine, $C_{36}H_{32}N_2O_6$. The bark of this tree was found to be remarkably rich in total alkaloids, 6 per cent. being found. The physiological action of these alkaloids appears to resemble somewhat the action of puketeine, and when the formula of the daphnandra alkaloids is halved there appears to be some chemical relation between the alkaloids from the two trees. Thus daphnandrine becomes $C_{18}H_{19}NO_3$, daphnoline $C_{17}H_{17}NO_3$, and micranthine $C_{18}H_{16}NO_3$.

THYMELAEACEAE.

Pimelia is a widely spread genus in New Zealand, the commonest species being known in the North Island as the "Strathmore weed" (*P. laevigata*). One or other of the species may be found at all elevations. The common daphne found in many gardens belongs to this family, and has the same poisonous qualities as the *Pimelia*. The bark

of every one of the New Zealand pimelias has the same physiological action when chewed—it produces after a few minutes an intense burning sensation in the mouth. Of the *Daphne mezereum* and *D. laureola*, Long remarks that all parts of these plants are acrid and poisonous, especially the bark and berries. The active principle of the daphne is supposed by Emil Pott to be or be contained in an acrid resin, although a vesicating oil is said by Van Rijn to be present. Drying does not destroy the poisonous property. The symptoms of daphne poisoning are severe purging, burning of the mouth and throat, and in severe cases narcotic effects giving rise to convulsions. Lauder ("Veterinary Toxicology," 1912, p. 259) records poisoning of horses after the consumption of daphne, the symptoms being intense colic, constipation, followed by dysentery and copious evacuation of faeces streaked with mucus, blood, and intestinal epithelium. Post-mortem examination showed stomach and intestines and colon much inflamed.

The symptoms of poisoning by daphne are given fully here in order that those interested in the closely allied pimelias of this country may have better opportunity of detecting poisoning by this plant, which, it is highly probable, has a similar action. In September, 1908, several draught horses died in the Wairarapa district, it was supposed, by poisoning from the *Pimelia* (see *Dominion* of 4th September). Leaflet for Farmers No. 55, issued by this Department, gives an illustration of one of the commonest New Zealand species of *Pimelia*. Experiments in this laboratory have shown that 0·82 gram of resinous dry alcoholic extract of bark was poisonous to a guinea-pig (Annual Report, 1900, p. 127). Bailey records that several of the Queensland species of *Pimelia* are suspected of poisoning stock, particularly sheep. In New Zealand, horses are the only animals which *Pimelia* has been suspected of poisoning, so far as the writer is aware. The recent bark of daphne applied to the skin produces inflammation followed by vesication, and the dried bark is the *Mezerei cortex* of pharmacy, used as a blistering agent or for the making of an irritant ointment. The New Zealand species of *Pimelia* might furnish similar preparations. There are about fifteen New Zealand species, some of them growing to a height of 5 ft., and quite worthy of cultivation in gardens as flowering-shrubs.

LORANTHACEAE.

The family includes those plants which are parasitic on other trees and known as mistletoes. Some of the New Zealand species must be ranked among the most beautiful flowering-plants of the world. From one of the species an infusion has been prepared and used by an Otago medical man as a heart-tonic. The English mistletoe, although belonging to a different genus, had repute as a medicinal plant. The fruit of this is said to be poisonous.

EUPHORBIACEAE.

In *Euphorbia glauca*, common on many New Zealand seashores, there is one representative of the poisonous *Euphorbia* genus. Suspicion should be attached to the New Zealand species on account of the poisonous nature of many of its allies, some of which are growing wild as naturalized plants in this country.

URTICACEAE.

This family includes the genus *Urtica*, containing the nettles, of which the only dangerous one is *Urtica ferox*, the ongaonga of the Maori or tree-nettle of the settler, common throughout New Zealand. Instances of dogs and horses having been poisoned by coming into contact with this species are given in the Chemistry Division's annual report for 1909 (Annual Report of Department of Agriculture, p. 180). The Australian *U. gigas* is reported frequently to kill horses, and apparently the ongaonga will do likewise if the horse is badly enough stung.

LILIACEAE.

Dianella intermedia, the turutu of the Maori, usually found growing under manuka scrub, is a tufted grass-like plant with very conspicuously beautiful fruits abundantly produced in autumn. In the *N.Z. Medical Journal* for April, 1891, Dr. Ernest Roberton, of Auckland, gave an account of the poisoning and death of a child, aged one year and nine months, in about eighteen hours after eating a number of berries of this plant. There were no convulsions or twitchings at any time except hiccough and laboured respiration, which were prominent symptoms at the last. No post-mortem was made. Suspicion has again been directed to this plant by a note in the *N.S.W. Agricultural Gazette* of November, 1908, by Mr. Maiden, Government Botanist. Several valuable pigs and some suckers which were just beginning to pick about died after eating the roots of a species of *Dianella*. Dragendorff mentions *D. nemorosa* and *D. ensifolia* as medicinal plants, and states that the roots were used in dysuria and other complaints. The former species is used in the Straits Settlements as a rat-poison.

Phormium spp., the well-known New Zealand flax, was, according to Goldie and others, used by the Maoris as a cathartic, the root or portion near the root being the part of the plant used. Dr. E. W. Bell also has an interesting account of its uses in a paper, "Medical Notes on New Zealand" (*N.Z. Medical Journal*, April, 1890, p. 135). Dr. F. A. Monckton, in the *Australian Medical Gazette*, bears witness to the efficacy of a strong decoction of the roots and butts of the leaves. He writes: "Somewhere about the year 1869-70 a letter appeared in the Melbourne *Argus*, signed by myself as Provincial Surgeon of Southland, bearing witness to the extraordinary healing properties of *Phormium tenax*, commonly known as New Zealand flax. From that time to the present I have used it in hundreds of cases, including lacerations and amputations of every description, and I have no hesitation in saying that there is nothing known in the Old Country that can equal it in producing healthy granulations. I use a strong decoction—the stronger the better—made from the roots and the butts of the leaves boiled for twelve hours. At one time I had to make it fresh every second day, as it readily ferments and deteriorates, but since carbolic acid came into vogue I keep it for any length of time by adding about an ounce of equal parts of carbolic acid and glycerine to every quart. I require no other antiseptic precautions, but simply syringe the lesions occasionally with it, and maintain cotton wool and lint soaked in it constantly to the parts affected. If there are no foreign matters to be discharged there will be no discharge." The doctor gives details of two very bad cases of shattered and torn limbs

which had been treated by him with perfect results by means of fresh flax decoction and nothing else. He concludes: "I might adduce proofs by scores of its efficacy, but if owing to these facts being made prominently known medical men can be induced to test the remedy for themselves, it will require no assertion from me to cause *Phormium tenax* to take the premier place as a granulating agent."

Sir A. H. Church (1873) investigated the chemistry of *Phormium tenax*, and isolated a bitter principle which he considered a tonic (*Trans. N.Z. Inst.*, Vol. 6, p. 260). Students of phormium would do well to consult the extensive bibliography prepared by Dr. B. D. Cross (1914) attached to a paper, "Investigations on Phormium" (*Trans. N.Z. Inst.*, Vol. 47, p. 61). The bibliography was not published, but is filed for reference in the Dominion Museum Library.

THE DEVELOPMENT AND FUTURE OF ELECTRIC MILKING IN NEW ZEALAND.

LAURENCE BIRKS, B.Sc., M.Inst.C.E., &c., Chief Electrical Engineer, Public Works Department, in the *New Zealand Journal of Science and Technology*.

Following an article by the author on electric power for milking, in Volume 4 of the *Journal*,* it is of interest to note the present position of this development, which promised and still promises to grow to such large dimensions, though naturally the drop in prices of agricultural products generally has delayed the extension. The returns show that there are already over a thousand milking plants operated electrically in the Dominion from public electric-supply systems in addition to those operated from private electrical installations, and the number is increasing rapidly.

In Canterbury electric power is as yet generally available in only three farming districts, and the numbers of electrically operated milking plants in these districts are—Tai Tapu district, 36; Eyre County, 4; Rangiora County, 32; the charge being £21 per year per 3 h.p. motor.

The supply will be available this season in the Banks Peninsula, Ellesmere, and Kowai Electric-power Districts, and it is anticipated that the season will open with about fifty milking plants in each district. The charge in these districts will be £6 per horse-power per year, plus a unit charge of 3d. for the first 80 units per month, 2d. for the next 120 units per month, and 1½d. for all over 200 units per month.

In the Hawera Electric Supply Company's area there are fifty milking plants operated electrically. The charge is by meter at the rate of 4½d. per unit, less 10 per cent., and the consumption and annual cost for four typical milking plants for last season were as follows:—

Farm.	Number of Cows.	Total Units.	Annual Cost.
			£ s. d.
A	75	1,801	30 8 3
B	50	1,001	17 6 10
C	34	706	12 16 0
D	28	502	8 16 0

* Reprinted in the *N.Z. Journal of Agriculture* for August, 1921.

Monthly Demand (Units).

Farm.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.
A ..	159	252	148	212	242	188	192	250	132	26	..	..
B ..	90	144	100	115	120	104	115	141	72	..	..	..
C ..	63	73	108	69	123	90	96	84	..	..	..	..
D ..	51	81	51	69	81	57	57	75	..	..	..	..

These figures correspond fairly closely to those given in the previous article for the Canterbury examples—viz., 1,244, 922, 675, and 1,919 units per year—and the distribution over the year is practically the same. They work out at 0·38d. to 0·49d. per pound of butterfat.

The reduction of demand for the midwinter months is, of course, particularly advantageous to the electric-supply authority in that it permits of the sale of the power elsewhere at the time when the demand for lighting and heating is the greatest, thus improving the load-factor.

In the Stratford Borough area eight plants are operated electrically, the charge being 4d. per unit, with a maximum of £15 per year.

The Murchison County has just installed a 100 h.p. automatic generating plant, using an old gold-mining water-race, and has run nine miles of reticulation, to which four milking plants are already connected.

In spite of the recent depression in butter-prices, the conversion of the milking plants in the Waikato district to electric drive is proceeding rapidly. The distribution in the farming districts of the power from the Government plant at Horahora Rapids is in the hands of four Electric-power Boards—viz., Thames, Te Awamutu, Central, and Cambridge. Supply was commenced in Thames and Cambridge districts early in 1921, but in Te Awamutu and Central it was practically into the opening of the milking season before supply was generally available, and, as a result, the conversion of the majority of the milking plants was postponed until the coming season. In spite of this the proportion is very substantial, as set out in the following table :—

——	Thames.	Te Awamutu.	Central.	Cambridge.
Supply commenced	11/3/21	26/8/21	13/7/21	28/4/21
Number of milking plants in whole district	2,000	850	600	200
Number within reach of the mains ..	900	700	330	250
Number already converted or being converted to electric drive	450	150	250	100

[NOTE.—This table is brought up to 6th March, 1923.]

The rates for energy in Thames Valley are £21 per year up to 7,000 lb. of butterfat produced, plus ½d. per pound of butterfat in excess of 7,000 lb. This works out at about ¾d. per pound of butterfat for a herd of thirty-five cows producing 7,000 lb. of butterfat per year, and proportionately higher for a smaller herd and cheaper for a larger herd, down to 0·48d. per pound for a herd of a hundred cows of good

average yield. In the Te Awamutu district the rate is £6 per year per horse-power of connected load (usually 2 h.p.), plus a unit rate by meter of 3d. for the first 80 units per month, 2d. for the next 120 units per month, and 1½d. per unit for all over 200 units per month. In the Central and Cambridge districts the rates are practically the same.

In the Te Awamutu district the following are a few representative costs at the above rates:—

Number of Cows.	Horse-power.	Cost of Electricity for Year.
		£ s. d.
18	1	15 18 6
29	2	19 1 9
90	2	33 2 3
102	2	28 19 0

These include the highest and lowest charges in this district, the balance ranging between £20 and £30. They range in cost per pound of butterfat from ⅓d. in the large herds up to 1d. in the smallest herd.

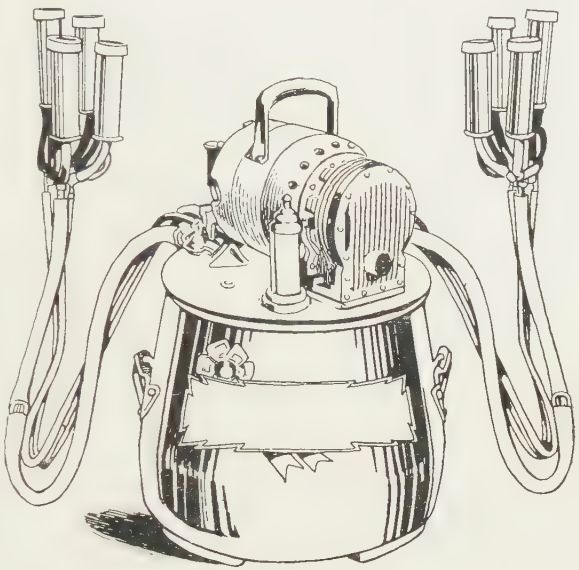
The competing source of power for milking purposes is benzine at £1 1s. to £1 10s. per case, according to the distance of cartage from the railway-station, the consumption usually ranging from twenty to fifty cases per year. The electric power thus has no difficulty in competing on the score of cost of fuel alone, apart from the lower cost of maintenance, lower first cost, and the great advantages of reliability, simplicity, and ease of operation of the electric motor as compared with the oil-engine.

The number of electrically operated milking plants is much less than it would otherwise have been, owing to the drop in the price of butterfat rendering the financing difficult to many dairy-farmers. The Thames Valley Board had met this position from the start by financing the farmers and undertaking the work of installing the electrical system, and hence the large proportion in its district. The Te Awamutu and the other Boards are now making arrangements to advance the cost of the installation on time payments, and, as a result, the proportion of electrically operated milking plants in these districts will probably be as large next season as in the Thames Valley.

As a further method of cheapening the cost of installation the Boards are arranging, where practicable, to call comprehensive tenders for the whole of the wiring and installation of motors for groups of farms up to fifteen within a given district simultaneously. As a result of the arrangement, applications for electric supply are being received so fast in some districts that it is difficult to deal with them all. Moreover, owing to the saving in transport expenses on the part of the wiring contractors, the cost of the installation is materially reduced by this grouping of the work of installation.

In addition to those districts in which the supply is already available, the reticulation is being erected in several other districts, particularly in the Southland, Manawatu, Rangitikei, Horowhenua, Wairarapa, Opunake, and Kaponga districts, where the necessary plant is being installed, which will involve a large increase in the number of electric milking plants in operation within a couple of years.

The history of the development of electric-power milking has been the replacement of the standard 3 h.p. oil-engine driving the ordinary releaser milking-machines by, first, a 3 h.p. electric motor. This was found to be largely in excess of the power actually required, and that even 1 h.p. will operate sufficient milking-machines at once to deal with a herd of a hundred cows. But a large proportion of the herds range from ten to twenty cows, and for a herd of this size a plant capable of milking two cows at a time is all that is required. A machine is now available of a much more compact type, capable of fulfilling this service, and driven by a motor of only ¼ h.p. Moreover, it has the great advantage that the motor vacuum-pump and releaser are all mounted direct on the lid of the bucket, and the whole outfit is thus exceedingly portable, and can be carried about in one hand, thus reducing the cost of the building and accessory equipment required in connection with it to a minimum. The complete apparatus is shown in the figure herewith. The cost of operation will also be much less than the standard 1 h.p. or 2 h.p. plants, though, of course, with the self-contained plant the separator and water-supply pump, if required, cannot be driven from the same shaft as is usual with the larger installations, and separate motors will have to be installed for this purpose. The Thames Valley Power Board have fixed a charge ranging from £7 per year upwards for the energy for this ¼ h.p. outfit. Though it will probably not take the place of the standard arrangement for large herds of thirty to one hundred head, the ¼ h.p. unit will probably have a large influence in extending the demand for electric power for milking the smaller herds of the Dominion.



Areas in Orchards, Gardens, Tree-plantations, &c. — Particulars of the area in occupation in New Zealand under this class in 1921–22 (aggregated as 146,346 acres on page 123 of February *Journal*) are as follows: Commercial orchards—Bearing, 17,607 acres; not bearing, 7,604 acres. Orchards for private use only, 5,910 acres. Vineyards, 179 acres. Market-gardens, 4,262 acres. Nurseries and seed-gardens, 395 acres. Private gardens and grounds about residences, 57,927 acres. Plantations, 52,462 acres.

SLAUGHTERING OF STOCK.

WHICH IS THE MOST HUMANE METHOD?

Paper read by Major WILMOT C. QUINNELL, M.R.C.V.S., M.R.S.I., at the meeting of the Australasian Association for the Advancement of Science, Wellington (N.Z.), January, 1923.

WHEN Dr. Reakes, Director-General of the New Zealand Department of Agriculture, did me the honour of inviting me to present some paper for discussion at this meeting of the Veterinary Section of the Australasian Association for the Advancement of Science it appeared to me that the subject indicated in the title would be an appropriate one to submit at this juncture, for the following reasons:—

Firstly, as far as I have been able to ascertain, the technique of slaughtering stock for food has not been discussed by any previous gathering of professional men, although articles bearing on the matter have appeared from time to time in the New Zealand Press. Secondly, owing to the existing Government veterinary inspection of meat at all abattoirs and meat-works throughout the Australian States and New Zealand, I may safely remark that all we veterinarians at this meeting have at some time or other been employed in this highly important branch of the meat industry. Thirdly, it is a subject of some moment in England at the present time, as will be seen from the report published in the *Veterinary Record* of the 9th September, 1922, of the deliberations of the annual meeting of the National Veterinary Medical Association, held in the Guildhall, Bath, on the 2nd August, 1922, at which the following resolution was agreed to:—

> As there is a great diversity of opinion on the question of the humane slaughtering of animals intended for human food, and the subsequent effect on the flesh of the various methods used, we suggest that a Government Committee of inquiry be instituted to investigate the whole subject; the Committee to consist of members of all professions and trades interested.

During that discussion General Sir L. Blenkinsop read an extract from a letter to the *Daily Mail* by the secretary of the Association of London Retail Meat Traders, as follows:—

> With regard to the mechanical killer, the meat trade takes up this strong and unanswerable position—namely, that an inquiry must be held by the Government into the whole question of the use of mechanical implements in slaughtering. All reliable scientific opinion is, however, on the side of the pole-axe for slaughtering animals intended for food, and there is also ample evidence, from the men's point of view, that they consider the mechanical slaughtering implement to be dangerous.

It is apparent from these extracts that what is sought is the most humane method of killing stock at slaughtering-establishments. In the word "humane" we understand to be implied an active endeavour to discover and relieve animal-suffering, and especially to prevent it. As the world advanced in civilization, and social and humane instincts developed, the subject of animal rights and cruelty to dumb animals has attracted the attention of thinkers from earliest times. One of the maxims of the Buddhist and Pythagorean canons was "not to kill or injure any innocent animal." The rights of animals now are

subordinate to almost anything that can be construed into a human "want" or consideration, including flesh-eating, fur- and feather-wearing, hunting, and scientific research to save man from disease or prolong life.

The thought of pain among dumb creatures distresses many minds, but there is every reason to believe that pain among animals is less acute than in human beings. In order to live, man must kill, but in doing so his methods should be as merciful as those shown by animals that live upon other living creatures. To illustrate this I take the following extract from a most admirable article by a natural historian, Ernest Bryant, in *My Magazine* :—

> There comes to the memory, as we run the mind's eye over the flesh-eaters and preying animals, not so much a thrill of horror at their deeds, but a sense of wonder at their efficiency and unerring skill in causing swift, sudden, painless death. It is one of the most astonishing things in the world that dumb-brutes show as sure an instinct for an instant, fatal blow as if they had studied anatomy at one of our hospitals. A stoat knows exactly how to inflict instantaneous death upon a rabbit or a hare. An eagle or a raven goes as surely to the right spot for attack upon a fallen deer or weakening sheep as a fox goes to the fatal spot in a domestic fowl; and a humble spider, spinning her silken web in our garden, is unerring in her death-stroke as a cheetah that fastens its teeth in the straining throat of a buck. Whether the wound is made with sledge-hammer paws and vice-like jaws, or with the poison fang and stiletto of the insect, the end is almost certain of terrible but painless suddenness. Now, there is mercy in this. There is no conscious pity in a tiger, but it is so extraordinarily fitted to its volcanic outbursts of power that it kills too soon to hurt. It has such strength that it might hold its victim by means of its grapnel-like claws and munch it alive, but, as a rule, it instantly kills. A python has such appalling force that it could swallow its prey alive, but, throwing itself like a cowboy's lasso around the body, it gives one convulsive strain, then crunch, crack, and life is in a second squeezed from the victim's body. These things have been and must be. We find the lower world as devoid of mercy in intent as it is among cannibal human beings, and it shocks and stuns a civilized mind. But as these things must be, then it is consoling to believe that death comes to the victims with such a rush of expert art as to be painless, or at worst only the overpowering agony of a fleeting second. Thus, in so refining the implements of destruction in the slayers, in so incredibly perfecting the instinct for the right blow at the right place at the right moment, Nature is kind in her seeming cruelty.

MATTERS RELATING TO KILLING.

Before entering upon the question of various methods of slaughter it is essential to give a few introductory and explanatory notes on certain matters relating to killing, and thus avoid repetition when each system is brought under review.

Operation of Bleeding.—This is carried out by the opening of the (*a*) throat or cervical blood-vessels, or (*b*) chest or the anterior thoracic blood-vessels, its completeness depending on the following conditions: In all methods involving the destruction or injury of the brain there is danger of defective bleeding, as is the case with shooting, pole-axing, pithing with a spear—the animal drops in convulsions. The practice of "fidging"—using a cane 3 ft. long and thrusting it through the hole made by the pole-axe or through the incision made at the nape of the neck—by the action it produces on the body, breaking up nerve influences to blood-vessels, hinders blood-flow, and bleeding is incomplete. Animals whose heart receives a wound with the sticking-knife, termed "overstuck," will not bleed completely. With fatigue, excitement, or overheating (thermic fever), bleeding is incomplete. In bleeding, the

posture of the animal is a matter of some importance; the recumbent position is associated with diminished force of the circulation, and should therefore be avoided.

Speaking generally, the blood constitutes about one-twelfth of the total weight of the body. The amount of blood drawn at the time of sticking varies with the size, age, and accuracy of sticking, with the condition of the animal, and the length of time that has elapsed since it has taken food and drink. The quantity of blood, roughly speaking, may be put down as: In a young animal, eighteen months old, about 2½ to 3 gallons; in a three-year-old bullock, about 4 gallons; and in aged milking-cows, sometimes 4½ to 5 gallons. The rate of movement of the blood through the arteries is estimated to be about 1 ft. 8 in. per second, and through the capillaries at about 1 in. per minute.

Effects of Struggling or Convulsions.—Liebig, in his "Letter on Chemistry," mentions the case in which the flesh of a roebuck, which had struggled after having been caught in a snare, gave rise to symptoms of poisoning. According to Gautier, pigs have been fatally poisoned through being fed upon the flesh of a horse which had died during its struggles when being broken in; and, like Liebig, he has known of cases of human poisoning by the flesh of roebucks which had been in a state of terror or exhaustion. From these and many other cases that could be cited there can be little doubt that harmful physiological alkaloids are elaborated by cells of living animals, through undue violent movements of the muscular system during the process of slaughter, as in the cases of (*a*) roping and throwing a bullock preparatory to killing, and its striving to get free; (*b*) the use of the pole-axe and bullet-firing appliances, when the animal drops in convulsions; (*c*) the unnecessary practice of fidging, producing violent spasms of the muscular system; (*d*) the struggles of death—namely, the convulsions which declare themselves as a prelude to death. All these conditions may be avoided or minimized by causing concussion of the brain.

Reflex Action, Movement, or Motion.—In physiology this means those comparatively simple actions of the nervous system in which a stimulus is transmitted along sensory nerves to a nerve-centre, from which again it is reflected along efferent nerves to call into play some muscular, glandular, or other activity. The actions are performed involuntarily and often unconsciously, as is the contraction of the pupil of the eye when exposed to strong light.

Cadaveric Rigidity, "Setting," or Rigor Mortis.—This condition is the characteristic stiffening of the body caused by the contraction of the muscles after death. It comes on more or less speedily according to temperature or climate, and also after death under different methods of slaughter—both of which circumstances also influence its intensity and duration. It is retarded by cold, but in very hot weather the rigor is slight and brief, or may hardly be appreciable. The relaxation of the carcase as the rigor passes off is one of the earliest signs of incipient decomposition.

These phases of the subject are of some importance in considering the merits and demerits of various methods of slaughter, when reference is made to "duration of bleeding," "duration of reflex," "amount of blood," and "keeping-qualities of meat."

METHODS OF SLAUGHTERING.

(1.) Pole-axing, followed by Bleeding.

This is the usual method of slaughtering cattle in England. The implement of knocking-down is a bull-head axe or pole-axe, a weapon or tool consisting of an axe-head on a long handle, combined with a blade like a pick or punch. After the animal is secured by being tied with a rope round the neck to a ring in the wall or floor, the slaughterman strikes it on the forehead with the pole-axe, the punch end of which crashes through the frontal bone into the brain-case, mutilating the brain-substance. On the beast falling to the ground it is immediately pithed, after which the fidging-cane is thrust through the incision at the nape of the neck and vigorously worked about until the limb-movements cease. The butcher then sticks the beast by severing the anterior thoracic vessels, when the life-blood gushes out. The average duration of bleeding is about two to three minutes.

Similar disadvantages apply to this method of slaughter, but in somewhat lesser degree, as are found in the use of mechanical killers that cause mutilation to the brain and, together with the practice of fidging, bring about a condition hindering complete bleeding of the carcase. Again, the operations of pole-axing and bleeding are carried out on the same floor; the recumbent position of the body on the floor does not facilitate accurate sticking, as it at times causes the unsightly condition termed "bodying" (blood-effusion under the membrane lining the chest-cavity).

(2.) Pithing or Spearing, followed by Bleeding.

This is the usual method in vogue throughout the slaughterhouses and meat-works of Australasia. The instrument is a spear, consisting of a long pole with a chisel-shaped steel attachment at one end of it. The butcher stands on a plank in the pithing-pen, just above the head of the animal, and thrusts his spear-end into the space or hollow at the base of the skull, dividing or injuring the spinal cord at its junction with the brain. The animal immediately drops. The slaughterman enters the pen and completes the pithing operation by a stab with a sharp-pointed knife in the occipital region. The animal is then pulled out of the pithing-pen on to the dressing-floor, where the fidging-cane comes into operation, after which it is bled, being stuck in the thoracic region.

A very important objection to this mode of killing is that on the animal being stabbed with the spear it drops in convulsions, in many cases lasting a considerable time, depending on the degree of injury to the spinal cord. Apart from the actual system, it is the practice in some slaughtering establishments to run a number of cattle into the pithing-pen at one time, so that the killing of one is done within the sight of the others, which causes them much unnecessary suffering while waiting their turn. Further, the use of the spear or pither must be in skilled hands. Sometimes even an efficient operator misses the vital spot; in such cases the animal becomes infuriated, and the slaughterman may lose his temper, with the result that his poor victim receives many stabs before it is finally despatched. Pithed or speared animals do not seem to bleed so well; spearing causes the retention of much blood

in and around the neck region, giving rise to a condition of "dirty neck," which becomes more noticeable and detracts from the appearance of frozen fore quarters on their being thawed for sale.

(3.) Direct Bleeding, Cervical or Thoracic, without Stunning or Shooting.

This is the common method of slaughtering sheep, and, in some places, calves and pigs. It is also practised by the Jews, Mohammedans, and races of a number of other countries for the slaughter of all animals intended for food.

Sheep: The animal is cast on its side on a wood grating, and is held firmly by the slaughterman placing the weight of his knee on the sheep's shoulder. He grasps the chin with his left hand, at the same time bending its head back to extreme tightness. The knife is then sharply run across the throat, severing the windpipe and the principal blood-vessels and the spinal cord as well, as he forcibly dislocates the neck of the animal. The sheep bleeds into a special blood-drain for collection, while the sliding-door of the waiting-pen is pulled down on the body, which holds it fast during the death-struggles.

Calves: These animals are usually hung up by the hind legs, and sometimes they are stunned by a blow on the head with an axe-head; in other cases they are pithed with a knife-stab at the nape of the neck; in yet other cases they are bled without previous stunning or pithing.

Pigs: The method of slaughtering pigs at bacon-factories and abattoirs consists in the animal being hoisted by means of a chain (which in turn is attached to the drum of a windlass worked by hand) by one of the hind legs to an overhead bar. The moment it reaches this bar the slaughterman sticks the pig with a sharp narrow-bladed knife, severing the anterior thoracic vessels.

In reference to sheep and calves, the method of slaughter—direct bleeding—is quite effective in despatching these smaller animals expeditiously and painlessly, and with no detrimental effect to the meat or market value of heads, brains, or tongues. In reference to slaughtering pigs, it would be a great advantage and more humane if the pigs were stunned by a mallet immediately they are hauled on to the rail; it would stop their horrible squeaking, the swaying of their bodies, and the paddling action of the fore feet, all of which are disconcerting to the sticking operator.

The Jewish Method of Slaughtering Cattle.—The beast being brought into the slaughterhouse, a rope with a slip-noose is placed round its neck, and is fastened to a ring fixed to a post close to the flooring, when it is made taut, the head being thus brought close to the ring; a second noose of chain is passed round the hock or hind shank, and is drawn sharply to cause the creature to fall or to be cast down easily by the attendants on its side. The leg-fastening having been firmly secured, the head is twisted back to extreme tightness. The Jewish skilled operator then appears, and, with a knife the blade of which is about 15 in. to 16 in. in length and sharp as a finely set razor, cuts the neck through to the spinal column by drawing the knife swiftly and smartly across. The time from cutting the throat to the last throes of the dying beast, as a rule, is four minutes. It is claimed by Dr. Dembo, from a series of tests made by him, that in the case of

animals killed by direct bleeding (the Jewish method) one hour and ten minutes elapsed between killing and onset of rigor mortis, and in the pole-axe method two hours and thirty-five minutes. Hence the progress of putrefaction is much less rapid in Kosher meat than in meat slaughtered by the pole-axe.

The law of England makes special allowance for the Jewish mode of slaughter. The method is essentially a humane one, as in the sheep insensibility at once supervenes; but the fact of other subjects being much larger, and the cutting of the throat crosswise, causes the blood to gush and spout in all directions, rendering this detail horribly repulsive. Further, it has been noticed that the butchers have occasion to sever these cervical blood-vessels again, consequent on their swelling and becoming partially closed, with the object of hastening the flow of blood. I fail to see why the Jews do not adopt stunning with the hammer preparatory to bleeding, thus dispensing with the process of roping and casting of the beast, and the unnecessary excitement, terror, and struggling of the animal on being under restraint for killing. Again, the Mosaic law is very strict regarding the killing of animals for food, and its ordinances are such as to secure to the fullest extent the removal of the blood from the carcase. This object would be far better accomplished by stunning with the hammer, as will be discussed later.

(4.) Shooting followed by Bleeding.

The first improvement on the ordinary pole-axe was a mechanical killer invented in Germany and known as the slaughter-mask. The apparatus consists of a leather mask with a metal-plate attachment containing a hole into which a hollow-ended bolt is placed. The mask is adjusted over the forehead of the beast, and then the bolt is tapped with a mallet, driving it through the cranium into the brain. The animal is then pithed with a knife and bled. Since this invention many instruments—bolt-striking and bullet-firing—have been designed on similar lines, such as the Kleinschmidt spring-bolt apparatus, Cash's and Behr's pistols, the Siegmund shooting-mask, Stachl's shooting-apparatus, the Speary killer, Stoff's Swedish and Greener's Safti killer, and latterly the R.S.P.C.A humane killer and the R.S.P.C.A. slaughtering-pistol.

From personal experience, and from information on the subject gathered from reports on the scientific tests and demonstrations made, I have learned sufficient to prove that this method of shooting has no advantage over the ordinary modes of slaughter in daily use at slaughtering-establishments, but, on the contrary, has shown the following disadvantages in its employment: There is a certain amount of danger in the use of these bullet-firing instruments. The shooting does not appear to be as humane as the ordinary methods in daily use, as animals are not always rendered unconscious, and there is no reduction in the duration of the reflex action. Animals do not bleed so readily and completely, therefore the keeping-qualities of meat are affected. In the case of pigs and sheep, the heads and brains have their market value reduced.

(5.) Stunning followed by Bleeding.

This is the method adopted for cattle in the slaughtering-establishments in America. The implement used for the purpose of stunning is a large sledge-like hammer, which should not be less than 6 lb. or

7 lb. in weight. The body of the hammer-head should be of even circumference, short and straight, with both ends slightly convex. The animals are driven one at a time into a specially constructed narrow pen, having a platform on top, on which the operator stands. On entering the pen the animal's attention is attracted to the small opening in the front partition, and while peering through this the blow is dealt, the slaughterman dropping the beast with one blow of the hammer high up on the forehead. One of the side partitions then slides up, and the stunned animal is automatically thrown out to the dressing-floor. The butcher immediately places a leg-chain around one of the hind fetlocks, the chain is hooked on the hoist-chain, and the animal is hoisted by means of the driving-shaft, which in turn is worked by a dynamo in the slaughterhouse. The stunned animal is thus placed on an overhead bar, and is pushed along the track-bar to the grating over the bleeding-pit. With the animal thus suspended it will be apparent that the butcher can stick more expeditiously and with greater accuracy than with the beast lying on the floor; and, further, there is no soiling of the hide with blood. Bleeding is carried out by opening the large anterior thoracic vessels, and the animal being suspended by the hind leg ensures rapid and complete drainage of the carcase of its blood contents.

The effect of a stroke or blow from such a hammer as described is concussion of the brain—namely, a shock to the brain from injury, but without visible effect on its substance, thus differing from contusion as produced by the pole-axe or humane killers, where the brain-substance is more or less lacerated and accompanied with varied degrees of consciousness. Although the brain is the seat of emotion, reason, and sensation, it is of itself non-sensitive, as portion of it may be cut away with little or no effect. An animal deprived of the cerebrum or forebrain retains the special senses of sight, sound, taste, &c., but the intellectual faculties are lost. In concussion there is a period of collapse; the animal lies stunned and motionless, with breathing slow and heavy—a desirable condition. The felled beast is now in a complete state of anathesia, or, pathologically speaking, analgesia—the incapacity of feeling pain in a part, although the tactile sense may be more or less preserved. Under these circumstances the operation of sticking must be absolutely painless. The quivering or twinge movement noticed on the butcher cutting off an elliptical section of the skin of the neck preparatory to the act of sticking the animal is only a tactile reflex—a reflex movement due to stimulation or irritation of nerves of touch. Therefore this sudden momentary twinge following on the butcher's incision of the skin does not denote pain as many are led to believe.

So, under this system of hammer and knife we obtain all that can be desired in slaughtering stock for food. Pain is avoided; bleeding is thorough, with no detrimental effect to the meat; and the operator requires little or no training. As far back as 1897 I recognized the need of more humanity in the slaughtering of animals for food, when Queensland was the first colony in Australasia to pass an Act of Parliament for the veterinary inspection of meat intended for export, and I had the honour of being appointed to administer that Act. Spearing or pithing was in general practice in those days, and I witnessed some

revolting and brutal exhibitions from the misuse of the spear or pither on stock that happened to be extra wild, or with those unfortunates comprising the tail-end of a big day's killing, when the operator was exhausted from work and heat. It was through seeing such sights that I advocated the American method, and was instrumental in getting it first adopted in the largest slaughtering-establishment, the Queensland Meat-export Company's Works at Brisbane, where they put through three hundred to four hundred cattle daily. The method was highly commended, and proved satisfactory in every way. Then, coming to New Zealand and taking service under the Government, I was posted in 1905 to the Wellington Meat-export Company's works for duty, and, as a new slaughterhouse was under construction, I recommended the then manager, the late Mr. Dilnot Sladden, to adopt the hammer-and-knife system of slaughter. This was done, and proved itself far preferable in every way to the old mode of spearing and pithing.

CONCLUSION.

Finally, after the experience of life's practical knowledge relating to this subject, gained not only in Australia and New Zealand, but in England, Scotland, and France during the period of five years from 1915 to 1920, I state my opinion that there is no method so far devised which is more efficient in causing swift, sudden, painless death than the employment of the hammer and knife. It should one day become the universal method of slaughtering stock for food.

COW-TESTING ASSOCIATION NOTES.

W. M. SINGLETON, Director of the Dairy Division.

In the January number of the *Journal* interim statistics were given regarding the number of dairy cows under association test in the Dominion. We are now in a position to complete the figures. It is calculated that this season there are some 78,756 cows whose yields are being systematically authenticated. This number, compared with last season, represents an increase of 33,192, or 72 per cent., which must be accepted as very tangible evidence of the rapidly increasing appreciation of the value of this work.

Keeping in mind the total just mentioned, it is interesting to trace the figures from year to year since, in 1909 10, the first cow-testing association in New Zealand, comprising 815 cows, was organized by the Department and conducted at Dalefield, in the Carterton district. The following year there were four associations, testing 4,317 cows, which the next season increased to eleven associations with 13,440 cows; a season later (1912–13) showed 25,000 cows. Then came the war period, bringing its labour and other difficulties, which naturally retarded the progress of the work under review. Taking up the figures at the conclusion of the war, 25,200 cows were calculated to be on association test during 1919–20, 35,757 in 1920–21, 45,564 in 1921 22, and, as previously stated, 78,756 for the current season. The latter number of cows is included in 135 associations.

While the present total, standing alone, appears large, and is undoubtedly praiseworthy, it must not be overlooked that it represents only 7 per cent. of the total number of dairy cows in New Zealand, and very much more remains to be done before the position can be regarded as really satisfactory.

Under present economic conditions it is only by keeping the better class of cow that a reasonable financial return can be expected, and this in turn resolves itself into the fact that testing must gradually but surely make itself essential. The new herd will be classified only through the systematic use of the Babcock tester, and when the poorer producers have been culled and the better dairy cows mated with proven sires, testing will again be needed among the young heifers as they come to profit. Thus some day our farmers may look forward to the general testing of dairy cows by the association method in New Zealand. In so young a country, with many unbroken or only partly broken dairy farms and a large percentage of scrub cows and bulls, progress along this line comes slowly, but that it is surely coming will be apparent from the figures quoted.

AN EXAMPLE OF HERD-IMPROVEMENT.

The cow-testing returns which pass through this office afford many examples of herd-improvement, and it is proposed from time to time to place some of the more interesting cases before *Journal* readers. The following table indicates the average seasonal production of a herd which has been tested each season since the association of which the owner is a member was formed in 1910–11:—

Year.	Number of Cows in Herd.	Average Days in Milk.	Average Yield of Butterfat.	Association Average Yield of Butterfat.
			lb.	lb.
1910–11	26	..	183·00	222·02
1911–12	31	..	211·24	233·59
1912–13	27	244	234·04	235·72
1913–14	27	..	278·06	264·09
1914–15	24	249	246·68	233·65
1915–16	26	266	289·71	283·36
1916–17	27	276	282·73	267·07
1917–18	28	274	296·64	296·26
1918–19	26	288	349·57	266·25
1919–20	29	280	336·00	236·47
1920–21	26	268	285·24	209·03
1921–22	27	277	354·73	275·19

From these figures it will be seen that in twelve years the owner increased his herd average, with practically the same number of cows, from 183 lb. to 354·73 lb. butterfat per cow—an increase of 171·73 lb. Unfortunately, figures showing the average days in milk for the first, second, and fourth testing seasons were not compiled. It will be noted, though, that from 1912–13 to 1921–22 the average lactation period per cow rose some thirty-four days.

In the writer's opinion the average lactation period in New Zealand is too short. To obtain a maximum of production it is obvious that the milking-period must be increased, leaving a smaller

portion of the year during which the animal is not earning her keep. The period could reasonably be increased to ten months, and still leave ample rest both for the cow and the milker. Only by proving the cow with the staying-power, and breeding from her, can this end be attained. It is here that the certificate-of-record testing of pure-bred dairy cows plays an important part, as it indicates bulls from cows of proven yield and proven ability to yield profitably for a full year.

To revert to the table, it may be mentioned that the owner of the herd commenced using a purebred sire during the 1914–15 season, and it is apparent from the later figures that this animal's influence for improvement duly exerted itself. During 1917–18 the owner milked five heifers of his own breeding, and these had an average yield of 258 lb. butterfat.

For purposes of comparison a column has been included showing the association average for each season. The figures also reveal the fact that the seasons 1914–15 and 1920–21 were unfavourable generally, as not only was the herd average down, but the association average also showed a marked drop from the previous season.

It will be seen that this member's original herd, yielding an average of 183 lb. butterfat, was undoubtedly an ordinary herd, and that its yield was some 39·02 lb. below the association average. The association comprised twenty-four herds, in which the one in question stood fifth from the bottom. In 1921–22 his average herd-yield of 354·73 lb. butterfat exceeded the association average by 69·34 lb., and the association included thirty-six herds. He was then fifth from the top, and all the herds (excepting one) with higher average yield had fewer cows.

To sum up, and to put the case into money: For purposes of calculation it will be reasonable to assume an average price per pound of butterfat of 1s. 6d. Had the owner commenced in 1910–11 with a herd equal in yield to his 1921–22 herd, he would have had 171·73 lb. of butterfat more per cow, which at 1s. 6d. per pound means (in near figures) £12 17s. 6d. per cow, or, on a twenty-six-cow herd, £334 15s. Had the production of the herd remained unvaried at the highest figure for the twelve years he has been testing, it would have meant £4,017 more in his pocket.

These figures need no further comment—they speak for themselves. And the standard which the herd under notice has now reached is by no means an abnormal one, but one well within the reach of many. This basic method of making the dairy business pay is no secret, but should be clear to all thoughtful dairy-farmers. It lies (1) in the systematic and continued use of the Babcock tester per medium of the cow-testing association; (2) in the selection of the right foundation animals from which to breed; (3) in the use of a proven sire to which the selected cows may be mated; and (4) in the careful feeding and handling of the herd, with unrelaxing attention to detail.

Eucalyptus gigantea.—The State Forest Service states that in 1917 an experimental area of *E. gigantea* was planted on the Kaingaroa pumice plateau. Its establishment has proved successful, and demonstrates that this very valuable timber-tree is suitable for planting in districts of low winter temperature.

THE TOMATO-CATERPILLAR MOTH.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

THE tomato-caterpillar moth (*Heliothis obsoleta* Fab.) is one of the most widely distributed and destructive insects to field, garden, and orchard crops. It occurs throughout the world, attacks a wide range of plants, and is practically omnivorous. As a field-crop pest in New Zealand it is not so outstanding, although it is commonly found associated with army worms (*Cirphis unipunctata* and *Melanchra composita*), and feeds on the ears of maize, millet, &c. To the gardener and orchardist, however, it is of considerable importance, since it attacks tomatoes, beans, apples, peaches, &c.

The adult moth (Fig. 1) measures about $\frac{3}{4}$ in. in length. The colour and markings vary a great deal, being greyish-white, greenish, reddish-brown, &c. The hind wings usually have a dark area along the outside edge, while the front ones have darker transverse markings of varying intensity. During the spring months the first flight of moths appears. The moths are most active as evening approaches, when the females lay their eggs either singly or in batches up to nine hundred or more upon the stems or leaves of any one of the host plants. Within a few days the minute caterpillars hatch, and make a meal of the empty egg-shells before progressing in search of a vegetable diet. As they grow in size, damage caused by the caterpillars becomes more conspicuous, and it is then usually that the grower first becomes aware of their presence. In the case of the tomato or apple the caterpillar eats a hole through the skin of the fruit and excavates a large cavity within (Figs. 2 and 3), the damage being more apparent the older the caterpillar gets.

The caterpillar (Fig. 4) is ornamented by numerous stripes, the colour of which shows a great range of variation (reddish, blackish-brown, or greenish, &c.) in different individuals. When full grown the caterpillar measures up to $1\frac{1}{2}$ in. long, and leaves the fruit, usually dropping to the ground, into which it burrows to a variable depth according to the nature of the soil. Some have been found as much as 7 in. below the surface, but as a rule they do not burrow so deep. The caterpillar then constructs an earthen cell in which it transforms to the brownish pupa. The period between hatching from the egg and transformation to pupa varies from four to six weeks during colder weather, and from about three to four weeks in the warm seasons. The pupal stage varies from about a fortnight to a month according to climatic conditions.

The number of broods, which may vary from three or more, is also dependent on climatic conditions; the broods are not always well defined, there being a considerable overlapping. The insect passes the winter in the pupal stage underground, and the larvæ from the first spring brood feed for the most part on foliage or on immature fruit; the later broods are quite apparent from their depredations upon ripening fruit. During last November a considerable amount of damage to young apples was recorded from Hawke's Bay and Gisborne by the Orchard Instructors for these districts (Mr. W. H. Rice and Mr. M. Davey respectively).

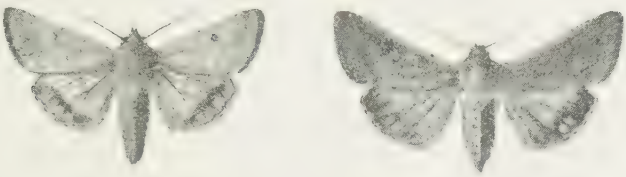


FIG. 1. ADULT TOMATO-CATERPILLAR MOTHS. ABOUT NATURAL SIZE.
[*After Kentucky Ag. Exp. Stn. Bull. 187.*

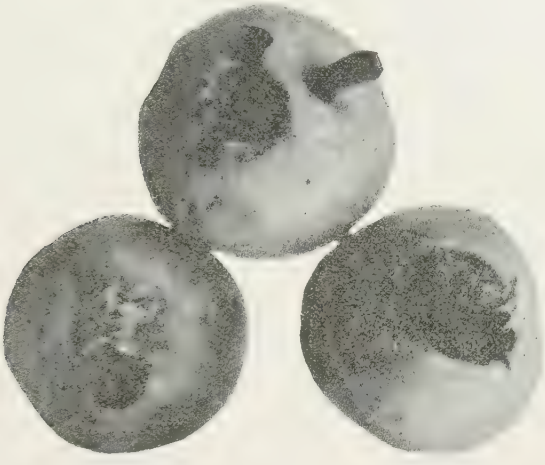


FIG. 2. YOUNG APPLES DAMAGED BY TOMATO-CATERPILLAR MOTH. NATURAL SIZE.

FIG. 3. TOMATO-CATERPILLAR ATTACKING YOUNG APPLE. NATURAL SIZE.
FIG. 4 (RIGHT). TOMATO-CATERPILLAR. × 2.

The tomato-caterpillar can be controlled by an arsenate-of-lead spray, particularly when the caterpillars are but little developed. In the case of crops, such as tomatoes, which are being more or less continually worked over, an outlook should be kept for very young larvæ, which can be readily destroyed by the spray. In view of the subterranean habit of the pupa, thorough cultivation, particularly during the winter months, is beneficial.

VINE-CULTURE UNDER GLASS.

(Concluded.)

W. H. TAYLOR, Horticulturist, Wellington.

DISEASES AND PESTS OF THE VINE.

Powdery Mildew (Uncinula necator).

THIS fungus appears in the form of greyish patches of mould on leaves and young shoots. Where neglected the whole surface of the leaves may become covered with the mould. On the berries it at first appears as a white powder, like lime, but when much developed the mould looks like a grey felt, completely enveloping the berries. Powdery mildew is known to most grape-growers by its old name of *Oidium Tuckeri*. While one of the most destructive vine-diseases when allowed to run its course without effective check, it is yet not feared by expert growers. Probably no crops are grown entirely free from mildew, but where the vines are under expert management infection is of a trifling character and easily controlled. The frequent cases of crops being ruined by this disease are entirely due to mismanagement.

Attacks are most likely to occur during the early period of growth, when leaves, shoots, and fruit are all young and tender. If the attack is severe, and is not checked, it will persist during the whole season. Autumn attacks are also common, occurring in houses which have been free from the disease till that time. This is accounted for by the increased atmospheric moisture and longer nights at that time. In such circumstances, if the vines have been allowed to make a considerable amount of young growth, as is frequently the case, this is first attacked, the mildew then quickly spreading to the older leaves. Attacks at this time are of no particular consequence, however, as they do very little harm.

The spores of powdery mildew are present everywhere, but they develop only in circumstances suitable to their growth. The conditions that favour germination of the spores are excessive cold on tender vegetable surfaces. In vineries attacks usually occur in the morning, and are caused by the sun, or more frequently newly admitted air, reaching tender growth wet with the condensed moisture that collects during the night. This causes sudden evaporation of the moisture, which lowers the temperature on the affected surface nearly to freezing-point. Infection can be prevented by avoiding these conditions. The top ventilators should be opened before the sun shines on the roof in the morning, so as to promote a slight movement in the atmosphere of the house. This movement will increase as the temperature rises. The moisture on leaves and berries will thus be slowly dispelled, so that all will be dry before the sun gains much power. The bottom ventilators should be kept closed till the vines are dry, as admitting bottom air while moisture remains on the vines is the most frequent cause of mildew. Cold draughts may be caused by leaving open spaces where rods planted outside pass through the wall of the house. These spaces should be blocked with sacking, or by other means. Any other open spaces, such as occur under the plates, should be

stopped, and the glass should be kept in good repair. In medium climates the bottom ventilators can be kept closed till colouring begins, and this course is best. In warm districts it cannot be done, but in no case should they be opened before the foliage is dry. If these precautions are taken, and provided the aspect of the house and other conditions are suitable for grapes, mildew will not be a serious trouble. Mild attacks are always likely to occur, however, and should be watched for.

A dusting of dry flowers of sulphur, applied on the first sign of the disease, will control it. The sulphur must be quite dry, and, before use, should be placed between folded paper and well rolled with a dry bottle or rolling-pin. Sulphur-bellows may be necessary in large vineries, but for small houses the best plan is to carry the sulphur on a sheet of paper, and, holding the paper under a bunch or leaf—whichever has to be treated—lift a fair amount of sulphur and let it fall on the affected bunch or leaf. A slight jar will then cause most of the sulphur to fall back to the heap on the paper; but sufficient for the purpose will cling to the fungus. This method ensures an ample dusting being quickly applied; it arrests the progress of fungus not yet visible to the unaided eye, and no sulphur is wasted.

If mildew is not effectually checked in its early stages it may, during the stoning-period, become epidemic, involving the whole surface of the vine, fruit, leaves, and young bark. In such cases dusting with sulphur would have but little effect; more drastic treatment must be given. Mix a good handful of sulphur with sufficient milk (skim-milk will answer) to make a thin paste, beating out all lumps. Place the mixture in a kerosene-tin and fill up with tepid water; the water must not be more than tepid or the milk will curdle. About an hour before the sun leaves the roof of the house in the evening close all the ventilators and thoroughly syringe the whole of the vines and the walls of the house with the solution. The solution must be kept well mixed, this being done by discharging the syringe back into the tin now and again, and thrusting it nearly to the bottom of the tin each time of charging before pulling up the piston. Open the top ventilators before daybreak the next morning so as to dry the vines before the sun reaches them. On the evening of the second day after treatment close up the house again and thoroughly syringe the vines with clean tepid water. The writer has proved this method to be completely effective in getting rid of the worst attack of mildew. This treatment cannot, however, be recommended for use earlier in the season while the foliage is tender, as burning would be sure to result.

Vine Sclerotinia (Sclerotinia Fuckeliana).

The Department's Biologist has reported ripe grapes received from Auckland to be affected by this disease. On the leaves the disease shows as a mouse-coloured, fluffy mould. Ripe grapes are caused to shrivel to dark purple-coloured mummies, which remain attached to the stems. As the disease cannot occur except in a very damp atmosphere, which should not be allowed, it is not considered necessary to describe the fungus fully. Where it occurs, the conditions of the house should be altered by proper ventilation. The mould form of the disease can be checked by spraying with liver of sulphur at the rate

of ½ oz. to a gallon of water. All dead leaves and wood pruned off should be collected and burned, and the house thoroughly cleaned. These precautions should be taken even in the case of vines not affected by disease.

Grape-spot.

This disease, which rarely attacks any but thin-skinned white grapes, is stated to be probably caused by the fungus *Glœosporium fructigenum.* Brown spots—which increase in size, rupture the cuticle, and cause a rot—appear on ripe grapes. Once a berry is attacked there is no remedy, and affected berries should be cut off. It is not practicable to spray ripe grapes, therefore the only remedy is to increase the ventilation and prevent as far as is possible an accumulation of moisture during the night. This involves keeping late growths from crowding the trellis.

Shanking.

Sometimes the footstalks of the berries and even the stems of the bunches wither; they are then said to have shanked. This trouble is not caused by a disease proper, but by a cultural defect. Shanked berries fail to colour or ripen properly, and are sour and uneatable. Different opinions are held as to the exact cause of shanking, but all agree that it is a root trouble, and that it is induced by the roots being in sour soil. Sour soil need not necessarily be wet soil, though excessive wetness will cause shanking, and should be remedied by attention to drainage. Roots growing down into cold subsoil may be the cause, and they should be encouraged to remain nearer the surface. Again, when the vines are furnished with leaves very thin in texture shanking may be expected.

All these things result in, or are the result of, an imperfect balance between root and top. Where there is too much organic matter in the soil soft spongy roots are formed which cause an excessive growth of soft foliage early in the season. Later on these spongy roots die, leaving the vines with insufficient roots to feed a gross leafage. The remedy is to restrict root-action by rigid and timely suppression of early lateral growth, in the manner described in the section of this series on routine management. In this way the formation of spongy roots is checked, and the results which would arise from their loss later on are not experienced. Cases are recorded where shanking had been extensive for a number of years, but had since been avoided by the simple means indicated above.

Scalding.

Scalding occurs both on leaves and on berries, in some cases being extensive and causing serious losses. This affection, like shanking, is usually spoken of as a disease, but this is not correct, as no pathogen has been found in either case. Scalding, or scorching, may be due to the direct action of the sun or to variations in temperature. When occurring on leaves it is in nearly all cases due to the action of sun-rays on damp foliage; it may occur at any time of the day. If foliage is allowed to crowd up against the glass the passage of air is prevented, and the leaves remain wet till dried by sun-heat; burning is sure to take place in such circumstances. To a lesser extent leaves may be burnt by the focusing of sun-rays through faults in the glass. The common glass used is full of such faults, and it is rare that some

amount of burning does not occur from this cause, but never to a harmful extent. Berries exposed to the direct rays of the sun may also be scorched, this generally occurring near or during the ripening-period. Scorching also takes place when the vine-leaves are very thin, and cases are met where considerable damage has been done in this way. Leaves of a flimsy texture are unable to withstand the heat of the sun, and burning results. This condition is due to a want of plant-food; it can be remedied by supplying what the vines need. Another cause of this condition is dryness at root and an arid atmosphere, resulting in semi-starvation with consequent feeble leafage, which is bound to scorch. It would perhaps be better to speak of these occurrences as "scorching," which it really is, rather than as "scalding"; they are not the affections usually meant by authorities when speaking of scalding.

Scalding proper occurs during the stoning-period, and sometimes causes very serious losses. It has been previously stated that the stoning-period is a critical time. The berries, during the three or four weeks of stoning, make practically no increase in size, and are very susceptible to injury, so that any attempt to force them into growth is likely to result in damage being done. Scalding in this case is not due to direct sun-rays, for berries that the sun cannot reach are scalded. It is due to a too-wide range between day and night temperature, combined with atmospheric moisture. Damping-down should therefore be reduced to a minimum, and a little top air should be left on all night, except during bad weather. More air should be given very early in the morning to dispel moisture and, above all, to prevent a sudden rise in temperature. During the day the temperature should be kept as low as is consistent with proper ventilation. The greatest danger is a sudden rise of temperature in the morning.

Warted Leaves.

This is a very common affection, occurring mostly in the warmer districts. The leaves affected are usually of a gross character, indicating that the roots are in rich soil. Such leaves are heavily charged with water, and are very susceptible to injury. The damage is done by sudden evaporation of moisture from the gross foliage, usually caused by a current of cold air admitted before the foliage has dried. The leaves have a rough surface, covered with warts or intumesences.

Aerial Roots.

It is not uncommon to see vines with bunches of aerial roots hanging down from each spur. The cause may be a warm and moist atmosphere combined with lack of proper ventilation. In most cases, however, it is due to faulty root-action, the roots having got down into cold soil. This again may be due to poor drainage. In any case it is not a desirable state and should, if possible, be put right.

Mealy Bug (Dactylopius adonidum).

This insect is aptly described by the common name applied to it, the term "mealy bug" serving to distinguish it from any other grape-vine pest. The rapidity with which the insect propagates, and its habit of depositing its eggs under the bark, beneath the scales of buds, and in crevices in the building, particularly the rafters, make it the

most difficult of all insects to get rid of. In small vineries it should not be a continuous pest, as it is possible to clean it out. The case of large houses is different; it would be impossible to devote the necessary time to the pest if the same means were adopted that are applicable to small houses.

The mealy bug has been the subject of more writings than probably has any other insect, and a good many recommendations have been made for its eradication. A number of different dressings for the rods have been recommended, such as washing with soft-soap or with paraffin, and dressing with a mixture of coal-tar and clay. Although these recommendations are well authenticated, and have been put into practice with good results, yet cases have occurred of the rods being killed by each one of them. The fault, however, has not been in the dressing, but in the method of application. A vine-rod is very porous, and, unless protected by its bark, is capable of soaking up anything of a penetrating nature. It is a general custom to scrape off all the bark which it is possible to remove, but, as pointed out earlier in this series, only that bark which is hanging loose may safely be detached; all that is firmly attached should remain. Bark is often scraped off because it is thought the bug gets under it, but the insect cannot get under unless the bark is loose. If a natural covering of bark is left, a fairly strong dressing may safely be applied. It appears, however, that there is danger in the use of strong dressings, and it is therefore best to avoid them.

Scrubbing the rods with hot water has been found by many growers, including the writer, to be effective. First remove loose bark and loose scales around the buds; then scrub the rods with a fairly stiff brush, using water at a temperature of about 130° F., which is hot enough to kill the bugs but will not injure the buds. In bad cases the rods should be scrubbed twice—at the time of pruning, and again a few weeks later. Before the buds begin to move, dress the rods with a solution of Gishurst's compound—8 oz. in a gallon of water, applied with a paint-brush. All prunings and leaves should be carefully collected and burned, and everything needful done to thoroughly clean the house, so as to get rid of bugs that have fallen to the ground. The rods must, of course, be taken down for cleaning; before tying them up again thoroughly and forcibly spray the whole interior with a solution of kerosene emulsion at a strength of 1 in 12. The wires of the trellis should be rubbed with a rag soaked in kerosene. While the vines are in growth keep at hand a tin containing a little kerosene and an old tooth-brush. When a bug is seen touch it with the brush just wetted with kerosene, and it will be instantly killed.

Tedious methods are not possible in large houses, however, and for these fumigating with hydrocyanic-acid gas appears to be the only way to get rid of the pest. This gas is of a deadly nature, and human life is endangered by any carelessness. It is therefore best to avoid its use where other methods can be made effectual. A good deal of care in its use is necessary while the vines are in growth, as it can easily kill tender foliage, either of the vine or of other plants, and can also injure the berries. In theory, damage from its use can be avoided, but it proves to be difficult in practice. It is noticed that authorities in England now advise its use only after the grapes have been cut, and this is, no doubt, the wisest course. As fumigation does

not kill the eggs, a second treatment should be given before the leaves have fallen.

Fumigating should be done towards evening, when the heat of the sun has declined; the temperature should not be above 70° F. The house should be made airtight, and the vines and building should be as dry as possible. After treatment, the house may be kept closed all night, but must be opened before sunrise in the morning. When opening the doors care must be taken not to breathe the air of the house, and the house should not be entered till one hour after the doors have been opened.

For every 1,000 cubic feet of space in the house use 4 oz. avoirdupois of potassium cyanide, 4 fluid oz. of commercial sulphuric acid, and 12 fluid oz. of water. Provide an earthenware basin for every 10 ft. of length in the house, the basin to be of a size proportionate to the amount of chemicals it will be required to hold. The necessary quantities of cyanide should first be weighed out and placed in pieces of tissue paper, which should then be placed in the positions where the basins will be. If the cyanide is in large lumps these must be broken until they are not larger than a filbert nut. The water should first be placed in all the basins, and then the sulphuric acid. The cyanide in the paper should be added last of all; begin at the basin farthest from the door, holding the breath and retreating as quickly as possible. The paper will delay the action of the acids for a moment or two. When sulphuric acid is added to the water heat is generated, and it is important that the cyanide be added before this heat declines; if it has cooled down the generation of gas will be slower and less in volume. A good grade of sulphuric acid should be used; low grades may contain nitric acid, which would cause burning.

Red Spider (Tetranychus telarius).

This is a minute brick-red insect that attacks the leaves. If present in great numbers the vines are debilitated, as the insects suck the juices from the leaves. It is troublesome only where hot, dry conditions prevail, and in most parts of New Zealand need not be a source of trouble. The way of avoiding attacks is to supply sufficient moisture to the roots, and to prevent arid conditions in the house by damping down and syringing. The warmer parts of the Dominion are most favourable to the pest, but the very conditions that favour the spider make it possible to use more water in the house. A number of recommendations for its eradication have been made, but so difficult is it to get rid of the spider without injuring the vines that all agree that treatment which will prevent an attack is the best course.

Thrips.

The thrip is a tiny insect, dark in colour when matured. It is a sucking-insect like the red spider, but is more destructive than that pest. Like the red spider, these insects thrive in dry conditions, and treatment that will prevent attacks by spider is usually effective for thrips. If an attack occurs, fumigation with X.L. All fluid or tobacco two or three nights in succession will control it. Tobacco should not be used when the berries are ripening, as the flavour of the tobacco remains for some time. A thorough cleaning of the vines and house on the lines previously indicated is essential to the riddance of both thrips and red spider.

TOP-DRESSING OF FIORIN GRASSLAND.

THE ALFREDTON EXPERIMENT CONTINUED.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Wellington.

In the *Journal* for March, 1922, the writer gave an account of a pasture top-dressing experiment conducted at Alfredton, situated in the Wairarapa bush country about twelve miles east of Eketahuna. The ground chosen for the experiment was a badly drained but gently sloping white-papa clay. The flora of the paddock two seasons ago, before top-dressing was undertaken, consisted almost entirely of grasses of the *Agrostis* species. This particular paddock was chosen for experiment because it was typical of much of the sheep-country in the surrounding district, and especially of part of the Tiraumea Soldiers' Settlement.

The 7-acre paddock treated was divided into seven plots, each an acre in area. The lower half of the paddock was limed, so that half of each plot received a dressing of lime at the rate of 1 ton per acre. The experiment has now been in progress for two seasons. In the 1921-22 season four of the plots were top-dressed, while three remained as control areas. No further fertilizer was applied last autumn, and Plots 6 and 7 were eliminated from the area under experiment. For the sake of convenience it will be well to repeat the arrangement of the plots and their treatment :—

Plot 1, control, (*a*) limed, (*b*) unlimed.

Plot 2, 2 cwt. Nauru superphosphate, (*a*) with lime, (*b*) without lime.

Plot 3, 2 cwt. Nauru ground-rock phosphate, (*a*) with lime, (*b*) without lime.

Plot 4, control, (*a*) limed, (*b*) unlimed.

Plot 5, 2 cwt. Ephos phosphate, (*a*) with lime, (*b*) without lime.

The higher portion of the paddock, which was unlimed, is somewhat irregular in contour, but the lower portion, which was limed and which includes half of each plot, slopes evenly towards the road, and contains soil of a fairly even type, so that comparison made from weights taken from the limed areas should admit of a reasonable degree of validity. The paddock chosen, so far as its contour is concerned, is typical of the average paddock likely to be top-dressed in the district, and for this reason the choice was the best that could possibly have been made in the circumstances.

The paddock has been inspected from time to time, and interim reports made on the various plots. It must be remembered that in such an experiment more is to be gained by a close study of pasture-composition and of the transitions that take place than is to be gained from a casual perusal of weights taken in December or January. There is ample evidence to show that top-dressing has been of great benefit on this area. During the first twelve months after the application of fertilizers the English grasses which had been sown in previous years, but had been smothered out by brown-top, began to make their appearance again. This was especially noticeable with perennial

rye-grass on the plots treated with superphosphate after lime. In the spring a great growth of meadow-foxtail was to be seen, while in January timothy-heads made their appearance. White clover made a good showing on all the manured plots.

A careful study of the flora reveals the fact that the omission to top-dress the paddock last autumn has been responsible for the marked intrusion of weeds and poorer grasses, notably tarweed (*Bartsia viscosa*), Yorkshire fog (*Holcus lanatus*), and sweet vernal (*Anthoxanthum odoratum*). It is evident that land such as that under study at present should receive an annual dressing of at least 2 cwt. of phosphatic manure per acre, but a larger dressing of 3 cwt. to 4 cwt. would be preferable. The following interim report will give some idea as to the state of the plots at the time of an inspection made on 10th October, 1922 :—

Plot 1 (control) : Fair growth, poor colour, not as good as central control. Sweet vernal and moss very noticeable, also red-top on unlimed portion.

Plot 2 (Nauru superphosphate) : Decided difference between this plot and No. 3 at the boundary. This plot is undoubtably the best in the paddock ; colour and growth good. Growth on limed and unlimed portions about the same.

Plot 3 (Nauru ground rock) : Unlimed portion looks decidedly better than the limed ; very little foxtail and cow-grass to be seen.

Plot 4 (control) : Easily picked out : sweet vernal noticeable ; poor colour. No perceptible difference between limed and unlimed portion.

Plot 5 (Ephos) : Fair amount of foxtail and clover showing ; unlimed portion slightly better than limed.

Weighings were taken from the various plots on 21st December, 1922. If we were able to balance the extra water-content of the grass at this date against the extra growth that would have taken place between 21st December and 18th January (the date on which weighings were made last year), it is probable that our results would admit of comparison with those of last season. The following were the green weights for this season (taken on 21st December) in tons per acre :—

(1.) Control, limed, 6·2 tons ; unlimed, 4·9 tons.

(2.) Nauru superphosphate, limed, 13 tons ; unlimed, 10 tons.

(3.) Nauru ground-rock phosphate, limed, 6·75 tons ; unlimed, 8·8 tons.

(4.) Control, limed, 5·9 tons ; unlimed, 6·7 tons.

(5.) Ephos phosphate, limed, 5·7 tons ; unlimed, 7·9 tons.

On a percentage basis the results may be stated as follows : Controls, unlimed, 100 ; controls, limed, 104 ; Nauru super with lime, 224 ; Nauru super without lime, 172 ; Nauru rock with lime, 116 ; Nauru rock without lime, 152 ; Ephos with lime, 100 ; Ephos without lime, 136.

The use of lime without manure does not appear so far to have shown any very appreciable effect this season, either in the actual pasture-composition or in the yields from the respective plots. It will be seen from the foregoing figures that the difference between the average from the limed controls and that from the unlimed controls is a negligible one. Nauru superphosphate used with lime has doubled the results given on the control plot. Superphosphate used alone has shown an advantage of 72 per cent. over the controls. Nauru ground rock used with lime has shown very little advantage over the untreated

plots. As might be expected, however, on this soil, which is very sour, the ground-rock phosphate used without lime has increased the yield, in this case by 52 per cent. Ephos with lime has not increased the yield, while Ephos alone (if experimental error is allowed for) has given somewhere about the same return as Nauru ground rock. On sweeter and drier soil Ephos would probably have acted much more quickly than rock phosphate used alone.

Since the rainfall and its distribution have such an important influence upon the growth of pasture-plants, the following record, kindly supplied by the Director of the Dominion Meteorological Office, is of interest :—

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Rainfall (Inches).													
1921	1·93	1·35	1·86	1·67	2·87	3·70	5·30	6·96	2·93	8·84	5·54	8·42	51·37
1922	3·82	2·14	8·39	4·67	1·54	1·92	3·34	4·22	2·36	4·23	4·15	4·12	44·90
Number of Wet Days.													
1921	11	4	9	9	13	16	19	18	11	21	14	14	159
1922	15	10	24	13	12	18	15	16	13	13	21	17	187

TESTING OF PUREBRED DAIRY COWS.

FEBRUARY CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE following list comprises the records of cows which received certificates during February, 1923 :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
August's Cherrybud ..	J. Nicolson, Kaupokonui	1 360	240·5	365	9,490·7	569·29
Holly Oak's Tiny ..	H. P. Pickerill, Ravensbourne	2 0	240·5	365	8,400·1	489·23
Wairoa's Gleam ..	H. J. Berry, Kaupokonui	2 38	244·3	365	8,321·5	488·78
Heroine's Pride's Idol	H. J. Berry, Kaupokonui	1 358	240·5	365	7,616·2	469·81
Ivondale's Glory ..	P. J. Petersen, Waitara	2 32	243·7	344	7,192·6	400·40
Abberly Naomi ..	H. E. B. Watson, Christchurch	1 326	240·5	365	8,144·4	392·70
Holly Oak's Rose ..	H. P. Pickerill, Ravensbourne	2 31	243·6	365	7,695·0	386·88
Ulster Lassie ..	W. A. Officer, Inglewood	1 297	240·5	325	6,064·3	372·18
Rosemont Princess ..	E. L. Rose, Pukekohe	1 342	240·5	365	5,922·6	356·28
Queen Maggie ..	A. Mouldey, Tirau ..	2 11	241·6	361	5,796·3	343·39
Nonpariel	S. J. Bennett, Kaupokonui	1 307	240·5	317	5,723·3	331·15
Middlewood's Mona ..	Kilgour and Gibson, Kiwitea	1 264	240·5	365	5,425·0	326·10

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS—*continued.*						
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Snow View Wish ..	H. Purdie, Waitara ..	1 338	240·5	259	5,055·0	310·58
Gowanbrae Melia Ann	R. W. B. Evans, Weraroa	2 13	241·8	300	5,874·7	309·58
Erinview's Queen ..	J. Murray, Woodville	2 0	240·5	316	6,016·5	303·94
Wattleflower ..	F. C. Ross, Kiwitea ..	1 364	240·5	328	6,124·3	300·32
Springbank Ringlet ..	E. S. Holdaway, Ballance	2 8	241·3	283	5,547·5	290·31
Adora's Jewel ..	H. Moreland, Newstead	1 218	240·5	365	5,825·5	285·90
Springbank Buttercup	E. S. Holdaway, Ballance	2 14	241·9	304	4,809·5	242·53
Springbank Beauty ..	E. S. Holdaway, Ballance	1 340	240·5	320	4,864·5	241·78
Senior Two-year-old.						
Collingwood's Angel	Mrs. E. Hellyer, Dunedin	2 149	255·4	365	8,420·0	518·77
Rapa's Silver Queen	S. R. Lancaster, Palmerston North	2 230	263·5	354	9,989·5	493·29
Holly Oak's Lady ..	H. P. Pickerill, Ravensbourne	2 135	254·0	365	7,791·5	470·66
Snow View's Zephyr	H. Purdie, Waitara ..	2 362	276·7	363	9,316·7	456·03
Aberbrothock's Effie	W. Corkill, Aratapu ..	2 194	259·9	326	5,306·2	315·23
Confetti	A. Eddie, Mangahao ..	2 332	273·7	365	6,203·7	279·97
Springbank Nell Ally	E. S. Holdaway, Ballance	2 119	252·4	304	5,476·1	272·41
Four-year-old.						
Silverdale Rose ..	G. Hodgson, Whakapara	4 185	332·0	365	9,734·2	549·69
Brookland's Claribelle	J. G. Kenyon, Hamilton	4 326	346·1	365	9,637·9	491·63
Roslyn Twin Girl ..	J. Torbet, Waiau Pa ..	4 19	315·4	365	7,549·0	442·19
Mature.						
Molly Mahone ..	C. Stevens, Maungatapere	7 322	350·0	365	11,692·5	682·61
Jewel Chimes ..	G. Hodgson, Whakapara	7 6	350·0	354	9,730·7	606·90
Georgia	C. Stevens, Maungatapere	6 257	350·0	365	10,750·7	604·73
Lady Winnie ..	E. Townshend, Aria ..	6 82	350·0	365	8,858·0	592·72
Verona	G. Hodgson, Whakapara	8 216	350·0	363	9,801·6	580·24
Pulchra's Queen ..	G. H. Bell, Oakura ..	5 79	350·0	281	10,241·2	538·86
Patch's Lily ..	R. C. Leach, Woodville	9 27	350·0	337	8,742·4	490·54
Lady Wattles ..	F. C. Ross, Kiwitea ..	5 94	350·0	365	9,002·2	414·63
Te Wi Pearl ..	E. Griffiths, Cambridge	8 308	350·0	333	7,251·5	413·82
Lady Mangalina ..	T. Foreman, Alton ..	6 324	350·0	341	6,610·0	411·21
Heather Flower ..	J. Linn, Normanby ..	5 319	350·0	315	6,697·8	381·76
FRIESIANS.						
Junior Two-year-old.						
Jessie Monona Johanna Oakview	H. R. Green, Kairanga	2 57	246·2	365	20,193·2	727·58
Coldstream Pontiac Wayne	V. Marx, Mangatoki ..	2 7	241·2	365	19,156·5	714·24
Coldstream Colantha Canary	Marchant and Sons, Cardiff	1 343	240·5	365	14,565·9	576·06

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS—*continued.*				
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Abbe Queen Segis ..	J. McAnulty, Winchmore Rural	2 60	246·5	365	15,975·0	513·10
Bainfield Betty ..	W. D. Hunt, Invercargill	2 163	256·8	365	14,558·1	491·81
Coldstream Rozine Fayne	Marchant and Sons, Cardiff	2 16	242·1	365	12,476·4	474·60
Bainfield Queen 4 ..	W. D. Hunt, Invercargill	2 16	242·1	365	11,528·5	443·68
Ellesmere Irene Mercedes	G. H. Hassall, Clarkville	1 312	240·5	365	10,961·2	422·55
Ashlynn 75th ..	D. Ross, Hamilton ..	1 313	240·5	354	10,802·9	415·75
Princess Pauline Pride	H. W. Hoskin, Mangatoki	1 309	240·5	352	11,804·1	406·72
Pareora Wild Rose Fancy	A. S. Elworthy, Timaru	2 42	244·7	365	13,643·2	405·89
Daffodil Lass 3rd ..	D. Ross, Hamilton ..	1 353	240·5	347	7,599·9	301·26
Dominion Lady Rowena	J. McAnulty, Winchmore Rural	2 47	245·2	253	7,895·3	256·31
Oaklea Felix Queen..	S. Knight and Sons, Ongarue	1 360	240·5	187	6,404·2	249·09
Johanna Royal Pride	S. Knight and Sons, Ongarue	2 61	246·6	333	6,584·7	247·36
Senior Two-year-old.						
Bainfield Vanity ..	T. R. Eades, Edendale	2 239	274·4	365	16,614·0	535·33
Junior Three-year-old.						
Rosevale Isobel ..	H. North and Sons, Omimi	3 86	285·6	365	19,627·8	613·74
Senior Three-year-old.						
Cordyline Cherry Cheer	G. Aitchison, Kaitangata	3 288	305·8	365	17,900·5	602·08
Blanco 4th 3rd 1st Daughter	D. Ross, Hamilton ..	3 243	301·3	364	13,976·2	565·84
Medbury Dutch Buttercup	G. H. Hassall, Clarkville	3 245	301·5	365	12,906·0	393·12
Junior Four-year-old.						
Oakwood Betty ..	W. D. Hunt, Invercargill	4 9	314·4	365	21,748·0	810·11
Midnight 2nd ..	F. O. Stack, Kiwitea..	4 98	323·3	365	12,783·3	468·18
Bainfield 28 ..	T. R. Eades, Edendale	4 70	320·5	320	12,754·5	455·41
Senior Four-year-old.						
Rosevale Nellie ..	H. North and Sons, Omimi	4 345	348·0	365	17,180·2	678·31
Knight Princess of Friesian Holm	W. A. Officer, Inglewood	4 353	348·8	281	10,560·0	414·05
Mature.						
Rosevale Beets de Kol	H. North and Sons, Omimi	7 133	350·0	365	24,072·4	819·31
Monavale Aaggie Regina	R. C. Allen, Piako ..	6 88	350·0	365	15,943·9	585·58
Colantha de Kol ..	Marchant and Sons, Cardiff	5 54	350·0	365	16,394·2	582·63

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS—*continued.*				
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Lakeside Diamond ..	L. McKelvie, Bull's ..	7 120	350·0	365	15,100·8	506·66
Jule's Colantha of Friesian Holm	John Stables, Riverlea	7 337	350·0	356	12,261·9	473·42
		MILKING SHORTHORNS.				
Junior Three-year-old.						
Dilworth Bridget ..	A. J. Melville, Buckland	3 54	282·4	315	7,594·6	308·80
Mature.						
Sandy 3rd of Cornwall Park	J. Pease, Matatoki ..	10 295	350·0	365	11,288·5	473·26
		AYRSHIRES.				
Four-year-old.						
Maud of Ivanhoe ..	A. M. Weir, Menzies Ferry	4 5	314·0	342	10,438·1	501·59
Mature.						
Dominion Blair Gowrie	Moumahaki Experimental Farm, Waverley	7 73	350·0	365	10,081·8	434·78
Bluebell of Glenweir	A. M. Weir, Menzies Ferry	10 347	350·0	292	9,717·9	407·37
Curly of Glenweir ..	A. M. Weir, Menzies Ferry	11 43	350·0	323	9,680·9	378·54
		RED POLLS.				
Dominion Morocco ..	Central Development Farm, Weraroa	2 34	243·9	365	9,189·7	341·96
Dominion Netherlana	Central Development Farm, Weraroa	2 35	244·0	365	7,008·4	331·26

Second-class Certificates.

		JERSEYS.				
Junior Two-year-old.						
Teuila	F. E. Day, Tamahere	1 332	240·5	365	4,552·8	271·58
Senior Two-year-old.						
Gift's Golden Maitland	F. Phillips, Otorohanga	2 292	269·7	311	4,996·9	279·06
Four-year-old.						
Una of O.K. ..	V. W. Nowell, Hawera	4 0	313·5	236	8,221·3	488·43
		FRIESIANS.				
Senior Three-year-old.						
Ardmore Plum 3rd ..	W. Potter, Mangere ..	3 330	310·0	364	12,268·7	424·28

Advice has been received through the High Commissioner, London, that the English hop crop of 1922 was 320,000 cwt., as against 240,000 cwt. in 1921, and that, in addition, 6,000 pockets of the 1921 season's crop remained unsold in December last. Owing to this position and the doubt existing as to whether the brewing trade could absorb the stocks in question, no import permits were to be issued for the present. The Hop Controller had fixed the average price of the 1922 English crop at £10 10s. per hundredweight, as compared with £18 in the previous year.

SEASONAL NOTES.

THE FARM.

FIELD CROPS AND PASTURES.

Autumn Sowings.

APRIL is a good time generally for the sowing of oats intended for threshing or cutting into chaff. If put in during this month they provide a lot of green feeding during the winter and spring, and ripen early. Algerians have many merits, and may be sown at the rate of 2½ bushels per acre. Where required a suitable manure is a half-and-half mixture of superphosphate and Nauru rock phosphate, 1 cwt. to 2 cwt. per acre.

May being recognized as the month for beginning autumn sowings of wheat, land intended for this crop should be cultivated all through April, as it is well to get the seed-bed prepared in advance. It should be borne in mind that manures do not take the place of cultivation, but are an adjunct to it. If the soil is not properly worked and consolidated no amount of fertilizer will ensure a good crop.

Where not already done the sowing-down of pastures should be pushed on as fast as possible, as late sowing generally means a big reduction in the clover content. From now on, particularly in the colder situations, it is often good practice to sow a bushel of Cape barley or one of the white oats with the grass-seed, to provide shelter for the young clover.

The sowing of winter and early spring forage crops should as far as possible be completed in March. Though much of this work is done in April, the value of early sowing generally may be stressed. Suitable crop-mixtures and fertilizers were indicated in last month's notes.

The Potato Crop.

From now on main-crop potatoes will be ready for lifting. The tubers should be carefully sorted, and those intended for marketing later pitted on a well-drained piece of land, the pit being well thatched to keep out frost and winter rains. Potatoes intended for seed should be stored in a cool, dry, well-aired shed.

Liming and Top-dressing.

In many districts April is the best month for liming. When lime is being applied to arable land it should be broadcast and worked into the soil in course of the final working. If the lime is applied as a top-dressing to pasture, the farmer should have fixed in his mind the necessity for following it up by an application of phosphates in the spring. Though more difficult to handle, crushed burnt lime is generally more satisfactory and more economical than carbonate, as about half the amount is the equivalent and gives quicker results.

Irrigation Farming.

Where irrigation farming is practised, especially in Central Otago, every endeavour should be made during April to break up land intended to be sown out in the spring. This ploughing should not be delayed until later, as the ground would then in all probability be too hard. From now on preparation should be made to have contour ditches cut, leading water to those places in the various paddocks which during the past season have proved hard to irrigate. This particularly applies to undulating country. Low-lying parts of the paddocks which become flooded during the irrigation season should have open drains cut, so as to allow surplus water to be carried off to lower levels. Ditches can now be cleared while still soft, and all boxes which have become disrepaired during the season should have attention.

On low-lying more or less flat country which has not previously been brought under irrigation, ploughing and preliminary levelling should be carried out with a view to laying out the land in a series of checks for border irrigation. This method, which was described in the December, 1921, *Journal*, requires well-levelled land, and much can be done in respect to such levelling at the time of autumn ploughing.

Feeding of Forage Crops.

At this period green maize is often fed to dairy cows, being cut as required and carted out. Sorghum which has come into head can also be fed like maize. Though opinions differ as to whether or not immature sorghum is poisonous, it is not worth the risk of feeding it before it flowers. Millet can be fed off green. It is advisable, if the area of millet is large, to feed off in breaks. Fifteen acres could be divided into three areas. Any excess from these crops should not be allowed to go to waste, but be conserved as silage. It is good practice to have such crops as maize and millet cleared up before sharp frosts set in.

The time is approaching when stock will be put on to hard turnips and swedes where such enter into the farm practice. Provision should have been made for the stock to have a run-off of pasture on which they can get the necessary roughage, which is essential to the health of ruminants feeding on root crops.

Reclamation of Tidal Swamp Lands.

The first operation in the reclamation of tidal swamp lands or mud-flats is the construction of a stop-bank. The general dimensions of stop-banks under New Zealand tidal conditions are 15 ft. to 20 ft. width at the base, 5 ft. to 7 ft. width at the top, and 6 ft. to 7 ft. in height. The bank-drain is first dug. For small areas a ditch 12 ft. wide by 5 ft. 6 in. deep, sloping to a bottom 4 ft. wide, is sufficient, while for larger areas, involving, say, several hundred acres, the bank-ditch should be about 18 ft. to 20 ft. wide, sloping to a 7 ft. bottom. The material from the ditch is best shifted back 5 ft. to 10 ft. and built into the stop-bank. When the banks are formed they should be immediately grassed with buffalo and tall oat grass. The bottom of the outside of the wall often requires to be revetted with manuka fascines or stones.

The outlet through the stop-bank should be concreted, and the flood-gate hinged and fitted close to the concrete. Usually a fluming is required at the outlet for about 7 yards to carry the water into the river channel, otherwise a large hole forms in the river-bank and tends to undermine the wall. Wing walls for about 5 ft. on each side of the outlet are often required to prevent erosion by the river.

In most cases it takes about two years for an area to settle, in which time the surface may sink 2 ft. or more. Fleabane (*Erigeron canadensis*) is frequently the first plant to appear. This weed is well liked by stock, and encourages the animals on to the area. In from two to five years, depending on the saltiness of the land, the area is fit to sow in grass. Surface sowing usually gives the best results. The rushes are burnt off, the grass surface-sown, and the seed tramped in with sheep to encourage germination. A suitable mixture of grasses is as follows: Italian rye-grass, 6 lb.; perennial rye-grass, 10 lb.; cocksfoot, 5 lb.; timothy, 3 lb.; meadow-fescue, 2 lb.; crested dogstail, ½ lb.; Poa trivialis, ½ lb.; cow-grass, 2 lb.; strawberry clover, ½ lb.; alsike, 1 lb.; white clover, 1 lb.: total, 31½ lb. per acre. As an alternative in the North, 5 lb. to 9 lb. of paspalum-seed could be sown with a rye-grass and clover mixture.

Open ditches are dug round the area at the foot of the hills, and several longitudinal drains are usually required. After the area has settled, the land is greatly improved by liming and underdraining.

—*Agricultural Instruction Service.*

THE ORCHARD.

THE LATER APPLES.

Of the work immediately ahead, perhaps the harvesting of the later varieties of apples stands first. This class of apple usually keeps well, and is placed aside in store for late winter and spring use. The keeping-qualities of these varieties were so highly rated that some liberties were taken as to the period and the manner of picking and storing them. Heavy losses have made the growers alive to the

fact that nature will not be thus slighted. Of the many factors causing "flesh-collapse" or "brown-heart," one is the over-maturity or mixed maturity of the fruit at the time of picking, as scientific investigators have recently plainly proved. However convenient it may be to defer the harvest in order to make one picking suffice, it cannot be done satisfactorily. This class of apple hangs very firmly on the tree after maturity, and the outside may show little signs of mellowness, but the texture of the flesh is affected, and its life in store is seriously shortened. Pick as soon as properly matured and store without delay, and the reputation of these sterling sorts will be what it was. To do this satisfactorily at least two pickings must be made, care being taken to instruct inexperienced pickers.

FRUIT FOR STORAGE.

It is often a matter for surprise to see the quantity of low-grade fruit put into store. Even if the space costs nothing, the depreciation and extra handling on this class of goods in storage quickly balances any little profit that it promised. Nothing below "Fancy" and a good second grade are worth store-room and a double handling these days. If there is no other use for lower grades they should be fed to farm-stock.

AUTUMN SPRAYING.

The business of harvesting the crop often leads to the trees being neglected at this period. A grower with an eye to the future will carefully consider the trees of each variety as the crop is gathered, and should any disease be seriously troubling them immediate steps can be taken to cope with it. A bad attack of woolly aphis may be very successfully dealt with by spraying at this season of its maximum activity. Red mite at this period is making arrangements to tide over the winter months. With the crop off and diminishing foliage, a serious attack can now be readily repelled with a good spray. Where black-spot has been epidemic a spraying of bordeaux, 3–4–50, now will go a long way towards cleaning up the trees and preventing a large measure of the infection arising from the leaves about to fall and that are such a menace in the spring of the year. The same remark applies to the treatment of rust and brown-rot of the stone-fruit trees.

COVER-CROPS.

Many orchards require a cover-crop to add nitrogen, fibre, and humus to the soil, thereby enriching it and improving its mechanical condition for the purpose of the cropping trees as well as keeping the land clear of weeds. Such a crop may still be sown; oats and vetches are one of the best at this season.

PREPARATIONS FOR PLANTING.

Those contemplating planting new areas during the coming season should now carefully select and order their trees or plants. These must not be merely well grown, but of the right varieties and the best stock. No amount of care will make up for deficiencies under these headings. If the land is in grass or other growth break it up now, so that grass and herbage is thoroughly decayed and the land cleaned before planting. Whether the crop is to be trees or strawberry-plants the present excellent opportunity of cleaning the land will not recur for some time.

—W. C. Hyde, Orchard Instructor, Nelson.

CITRUS FRUITS.

In those groves where it is intended to put down cover-crops these should receive attention as soon as possible. The most economical method, and the one which will be found to be the most thorough, is to employ the farm drill for this purpose, sowing fertilizer at the same time where necessary. Owing to the rather erratic season and heavy rainfall which have been experienced practically throughout the Dominion the autumn blossoming may be expected to show up somewhat earlier this year, and it is therefore advisable to refrain from carrying out further cultivation at this juncture unless cover-crops are required.

As there has been a shortage of New-Zealand-grown lemons for several weeks past several growers have been picking quite immature fruit from the trees, with the idea of curing for market. This class of fruit is of no value commercially. It is obvious that there can be no keeping-qualities in fruit that is not allowed to reach a fair degree of maturity, and for this reason no fruit should be harvested before it has reached a size of at least 1¼ in. to 1½ in. If curing is

to be carried out methodically the trees must be gone over once a month. While picking of immature fruits must be avoided, no lemons should be allowed to remain on the trees until they ripen off and become coarse and full of "rag."

Black aphis should be dealt with on appearance, using nicotine sulphate at 1–800.

FIREBLIGHT.

At this period it may reasonably be anticipated that infection will not make further appearance in the present season. Growers of pip-fruit trees should, however, remove and destroy any parts of a tree or trees that show suspicious symptoms—not only in their own interests, but also in those of their neighbours. Apart from this no further steps can be taken to deal effectively with this disease until the pruning season.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CARE OF THE PULLETS.

On all well-managed plants the general weeding-out of unprofitable stock will have been completed before now. This should enable the pullets to be provided with plenty of house-room and be made comfortable in every way. For many weeks to come it is the pullets that must be depended upon to fill the egg-basket. It should hardly require emphasizing that for them to do their best during the forthcoming season everything must be in their favour. The young birds should now be well settled down in their permanent quarters, as any change made in this direction just when they are on the point of laying or when they have commenced to lay is merely encouraging them to moult with the adult birds.

Any change of diet will also probably have this undesirable effect. Uniform feeding and management is not only one of the secrets of preventing a false moult, but it encourages a bird to attain its maximum of production. The best example of this is conveyed by the egg-laying competitions where the one diet is used practically from start to finish. While the food should be uniform in character it should also be fed with a liberal hand. Once the laying-period commences there need not be any danger of the birds being overfed. Remember that sufficient food is required not only to keep the birds in good physical condition but also for the production of eggs. The morning mash may consist of one part by measure of good-grade wheatmeal to two of bran, or, where a good quality of pollard is available, two of this to one of bran. In each case it should be moistened with milk, meat-soup, or boiling water, and mixed to a crumbly condition. Cold water will do for moistening purposes where milk or soup is not available, but by using boiling water the mash is made more appetizing, and consequently will be better relished by the birds.

Then, to secure a good winter-egg yield, animal food in some form is imperative. Where boiled meat is available this should be introduced into the ration by degrees up to, say, 1 oz. a day for each bird, preferably fed separately. In the absence of meat a good grade of meat-meal should be used. This may be included in the mash by degrees up to 8 per cent. of the entire mixture, while, in addition, some may be placed in a separate hopper and left for the birds to pick at all times. If ovarian troubles occur, this indicates that the ration is of too forcing a nature and that the amount of animal food should be reduced.

Equal parts of wheat, oats, and maize make a good evening meal. Where it is observed that the birds are leaving any one particular grain, this should be given in a reduced quantity. It is a good plan to give more at this meal than the birds require. Then, with the grain being fed in deep litter, the birds will be induced to exercise in the early morning, and thus keep warm. Exercise is an essential for the maintenance of good health and a heavy egg-yield.

Do not forget green stuff, such as chaffed lucerne, clover, watercress, &c.

To sum up, draught-proof houses (but with an abundance of fresh air) kept in a thoroughly clean condition and providing ample accommodation, well-sheltered runs, green feed, clean water, grit, and a generous supply of food (with a proportion of animal matter) are indispensable if the pullets are to do their best. In view of the present rising egg-market it will pay to give the pullets the best possible care and attention.

THE BREEDING-COCKERELS.

It is now full time that the final selection of cockerels should be made for next season's breeding-pens. In connection with this important work the necessity of choosing only birds of undoubted constitution cannot be overstressed. A specimen may exhibit good type, size, breed-points, &c., and have ever such a pedigree of performance behind it, but if there is the slightest evidence of a weak constitution it should be rejected. Constitution should certainly be given the first consideration, but laying-type, size, breed-points, and a knowledge of the birds' ancestors must also be taken in conjunction. Never be tempted to pick as a sire a very early maturing specimen, as such seldom or never grow to a desired size. To mate such stock invariably means a weedy progeny and unsatisfactory egg-production. It should be ever remembered that the male is more than half the flock, and that if profitable progeny are to be produced none but the best males should be bred from. When the final selection of the best specimens has been made, they should be provided with a free range under the most natural conditions possible. The latter point is one of the secrets in building up bodily vigour. As to the work of selecting breeding-stock, the novice would be well advised to secure a copy of the "New Zealand Utility-poultry Standards," and to follow the plates and particulars contained therein. A thorough study of this work will serve as an excellent guide to the desired type of bird—both male and female—to retain for breeding purposes. In addition, it will enable the novice to select the most desirable specimens for the utility classes at poultry shows. Copies of the Standards are obtainable from the Publisher, Department of Agriculture, Wellington, at a cost of 3s. each, postage free.

GEESE AND GANDERS.

A correspondent wishes to know how he can distinguish ganders from geese. Unless a person has had experience this often proves a difficult matter. The size of the neck gives some indication, being thicker in the male than the female, while the former is usually larger in body and presents a more masculine appearance. The sex may also be distinguished by shutting up the geese in a shed and bringing a dog in. The geese will usually lift their heads up and go to the back of the shed, while the ganders will lower and stretch out their necks, hissing all the time. In the case of Emden geese, the goslings when hatched are yellow. Some, however, are hatched with a grey tinge on their down. It is claimed that the grey ones are geese, and that the bright-yellow ones invariably prove to be ganders. This theory is, however, not accepted by all.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

PREPARATIONS FOR WINTER.

As the honey-flow is now definitely over for the season, and the extracting finished, the next work is the preparation of the bees for the winter. It is assumed that in most cases sufficient stores have been left in the hives. From 30 lb. to 40 lb. will be required to tide the bees over the winter and early spring. If sealed combs of honey from clean colonies are not available colonies that are short of stores should be fed as soon as possible with syrup composed of equal parts of sugar and water. It is better to feed heavily now where necessary than to wait until the bees have used up their meagre stores. The bees cannot leave their cluster during the cold months of winter and early spring to take down any syrup that may be offered them, or generate sufficient heat to evaporate any surplus moisture it may contain. It is not recommended to feed sugar syrup, but it is necessary in the absence of sealed honey stores, as there is a risk of introducing disease with the feeding of honey unless it is definitely known that the apiary from which it was obtained is quite free from foul-brood and has been so for some years. It is generally admitted that honey-fed bees have a better constitution than those fed with sugar, and will build up better in the spring. There is also reason to believe that some sorts of honey are better than others, but we have no definite proof. There is a marked difference in the specific gravity of our honeys.

The entrances of all colonies should now be reduced. The average colony will require an entrance 3 in. to 4 in. wide. If the entrance is more than $\frac{5}{16}$ in. high, this, too, should be reduced in order to prevent mice getting into the hive.

When stacking away the supers of combs for the winter place a sheet of newspaper between each super, and a roof or its equivalent on top to keep out mice and wax-moths. Pack away any foundation that may be left over in a light and air-proof box. It will become very brittle if left exposed to the atmosphere.

Keep a sharp lookout for foul-brood, and, if discovered, deal with it at once by one of the methods recommended last month, or destroy the colony. It does not pay to risk its spreading by robbing during the winter.

If robbing sets in, place a strip of wood in which an escape has been fitted across the entrance of the colony that is being robbed, and leave it until after sunset. Then reduce the entrance to not more than 1 in. in width.

WEAK AND QUEENLESS COLONIES.

Queenless colonies should be disposed of by uniting them with strong queen-right colonies. This is most readily accomplished in the evening when all field-bees have returned. After taking the roof and mat from the queen-right colony, place a sheet of newspaper immediately over the top of the frames and carefully place the queenless colony on top. No smoke will be required if the hive is handled gently. Weak colonies should be similarly united if the queen is of little value. If the queen is young, brood-rearing will probably be kept up for some time, and such colonies, though weak, will probably be worth saving. This is best accomplished by shifting them into a small hive, called a nucleus box, large enough to take only four frames.

—H. W. Gilling, Apiary Instructor.

THE GARDEN.

VEGETABLE-CULTURE.

Current Work.

SEEDS of an early variety of cabbage and lettuce for earliest use should have been sown a month ago. A larger kind of cabbage to succeed the early variety, cauliflower, onions, and more lettuce can now be sown. The cabbage sown last month should have been a true early Flower of the Spring type. These varieties produce very small heads. The plants should be set out in rows about 18 in. apart and 12 in. apart in the rows. The stumps should be pulled out when the heads are cut. The larger kind to be sown at the present time will require more space. In home-garden practice the stumps of these kinds may be left to produce sprouts. The sprouts make a better-flavoured vegetable than the first head. Sprouts are freely produced through summer and autumn, and will really carry on till the next spring crop is ready, giving a long succession of sprouts without labour. Of course, this plan is not suitable for market-gardening. Two kinds of cauliflowers should be sown, Snowball, Early London, or Early Paris for first use, and an Autumn Giant type to succeed the early.

Onions: Where it is desired to grow the Giant kinds seeds must be sown at once, these kinds being transplanted in spring. In districts where mildew is troublesome it is a good practice to sow keeping kinds also at this time. The advantage is that autumn-sown crops mature earlier than those sown in spring, ripening before mildew usually appears, or at least being so far advanced that mildew does little harm. The disadvantages are that the bulbs are likely to be rather large, and they do not keep so long as spring-sown bulbs. Some growers sow onions where they are to grow, others transplant. The latter plan is usually best, as fewer plants will bolt to seed. The former plan is practicable only on clean soil. If beds of any size became badly infested with weeds it would be impracticable to clean them, as it would have to be done by hand-weeding.

Turnips: If the winter crop has not been provided for it should be attended to at once, on the lines indicated last month.

Celery: Heads that have reached usable size should be moulded up. The heads will keep sound for a long time when thus treated, as they are protected from rain. Before moulding up remove any side sprouts there may be. Draw the stems together so as to keep soil from the hearts. Pack the soil firmly round the base of the heads to prevent sinkage, which might cause a bend in the stems and impair quality. Moulding-up should not extend beyond the solid

stems; a good amount of leafage should project above the soil. If too much of the green tops are covered the leaves may rot, and this may extend down into the stems, and heads be lost.

Green manuring: Vacant land should be put down to a cover-crop to supply humus. For this purpose lupins, rye, partridge peas, Cape barley, or white mustard may be used—whichever has proved best for the locality. In the colder districts probably mustard will do best, as it takes but a short time to grow.

Tomato Practice.

In an article on black-stripe disease, which appeared in last month's *Journal*, it is advised that where stable manure is applied to the soil a crop such as cabbages should be taken from the ground before tomatoes are planted. There is evidence of the efficacy of this plan. Some growers, however, now state that it does not do to plant tomatoes after cabbages. This conflicting evidence is easily explained. It depends very much on the quantity of cabbage-leaves ploughed in. If the quantity is large, bad effects are likely to follow, and if the stumps are also ploughed in, as is often the case, trouble is the more likely to result. In garden practice the stumps of cabbages and similar plants should be dried and burned, except that where the land is being trenched there is no harm done by burying them at the bottom. The danger from cabbages lies in the excess of green vegetable matter, but probably this is not harmful to crops other than tomatoes. The case of lettuces is quite different. This plant is likely to be affected by two diseases—rhizoctonia and sclerotinia. These also affect many other plants; but the lettuce, being the most susceptible plant and also because its bottom leaves are close to the soil, affords the most favourable conditions for the propagation of diseases, especially sclerotinia. This may be the cause of infection in other plants. Any plants that wilt or show signs of rot should be regarded with suspicion. They should be removed and buried deeply in the ground where they will not be disturbed again.

—*W. H. Taylor, Horticulturist.*

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 3rd March: *Peas*—Consumption restricted. New Zealand blue, on spot, selling slowly at 75s. to 79s. per quarter; buyers not bidding for shipments. Tasmanian offered, afloat, 87s. 9d.; buyers 83s. 6d. to 85s. New Zealand maple, spot values 105s. to 110s. per quarter; sellers offer February–March shipments 75s., March–April shipments 72s. 6d.; buyers 71s. Trade not active. *Beans*—Small trade. English supplies plentiful at 200s. per ton. Little inquiry for imported. Chinese offered at 190s. per ton. New Zealand prices nominal, 50s. to 52s. per quarter.

Noxious Weeds.—The Taumarunui County and Heathcote County have declared the following plants to be noxious weeds in the respective districts under their jurisdiction: African boxthorn; barberry; Bathurst burr; broom; burdock; Cape honeyflower; Capeweed or Cape daisy; cut-leaved psoralea; dock; elderberry; fennel; foxglove; giant burdock; goat's rue; gorse; hakea; hemlock; Japanese wineberry; kangaroo acacia; lantana; lupin; ox-eye daisy; pennycress; pennyroyal; periwinkle; prickly pear; spiderwort; St. John's wort; tauhinu; thistles (any species of stemless thistle, common plume or Scotch thistle, woolly-headed thistle, star thistle, and milk-thistle); tutsan; viper's bugloss wild borage; wild turnip; winged thistle. Masterton County has similarly declared broom, and Opotiki County Japanese wineberry.

Manurial Value of Whey.—Several inquiries have been received recently on this subject. The ash of whey contains somewhat less than one-third of its weight of phosphoric acid and a similar amount of potash, but there is only six-tenths of a part of ash in every hundred parts of the whey. The manurial value due to the mineral ingredients is therefore extremely small. There may, however, be a considerable indirect manurial value in the following manner: The soil bacteria are stimulated by solutions of sugars, and whey contains about 4½ per cent. of milk-sugar. It is quite possible that on some soils whey would have a beneficial effect, but whether it would be economical to use it in this manner can only be determined with a knowledge of all the circumstances of the case. Speaking generally, the most economical utilization of this by-product (in districts where sugar of milk is not manufactured) is as a pig or other stock food.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

VAGINITIS IN COWS.

A. B., Kamo :—

Last season a great many of my cows aborted, and they do not appear to be getting in calf this year. When in season I notice a slight discharge of blood whether they have been served or not. Last year several cows came back to the bull regularly, but proved to be in calf all the time. I have syringed the cows carefully with permanganate of potash, and also with carbonate of soda, just before service, but they do not seem to be holding. Can you advise a remedy ?

The Live-stock Division :—

We are of opinion that your herd is affected with abortion disease, giving rise to the abortions last season. However, from the symptoms you describe, it is evident that the cows are now suffering from vaginitis (inflammation of the vaginal passage). This condition is contagious and may be spread by the bull. As regards treatment, we have had good results from the use of sulphocarbolate of zinc, used as a vaginal douche at a strength of 1 dram dissolved in a quart of hot water and cooled to blood-heat. The cows should be washed out with this every second day for a fortnight. Some long-standing cases do not yield readily to treatment. Keep the affected cows separate from the healthy. Remove the bull if he is running with the cows, and wash him also with the same solution. While under treatment the cows should not be served.

CASTRATION OF HORSES.

"LEARNER," Rissington :—

Will you please give me some information on castration of horses ? I can tie them down, but am not an expert with the knife.

The Live-stock Division :—

The animal should be fasted for at least twenty-four hours prior to the operation, but water should be available. After the horse has been thrown and secured on his back, the sheath and scrotum should be well washed with a warm antiseptic solution and dried with a soft cloth. The operator stands directly behind the animal and, grasping one testicle firmly, renders the skin over it tense. Next a bold longitudinal incision should be made through the skin, when the testicle should appear through the wound. The testicle may be removed by any of the emasculative instruments. The operation is repeated on the other testicle, and the horse allowed to rise. Care must be taken that there is no rupture present before operating. The operation can be more easily understood if it is once seen performed by a capable man.

CONTAGIOUS MAMMITIS AND INFECTION.

"MAMMITIS," Waitahuna :—

Can you tell me if a cow which has contagious mammitis and is dried off is likely to infect others with whom she is running ? If she had another calf and was allowed to suckle it would it grow up a healthy animal ?

The Live-stock Division :—

There is no likelihood of a cow suffering from contagious mammitis and subsequently dried off infecting others running in the same paddock. If she were to have another calf and rear it there would be no danger of the calf becoming infected, as the quarter would, in all probability, be dried off.

COW WITH CATARRH.

"CATARRH," Albany :—

Could you advise me how to treat a cow suffering from catarrh ? Her eyes and nose are constantly running, and the trouble seems to irritate her nose a great deal, as she is constantly rubbing it, very often making it bleed.

The Live-stock Division :—

A careful examination of the nose should be made to determine if any foreign body—piece of wood, brier, &c.—has become fixed there, setting up the irritation. If nothing of this nature can be found, you might try syringing each nostril daily with a solution made by dissolving 30 grains of sulphate of zinc in a pint of water. The eyes should be bathed with a lotion made by dissolving a teaspoonful of boracic acid in a cupful of warm water.

GREASY HEEL IN HORSES.

H. HARGREAVES, Karamea, Westport :—

Please inform me whether greasy heel in horses is a contagious disease.

The Live-stock Division :—

Greasy heel is a diseased condition, principally in that region of the pasterns of horses in which the oil-glands (which secrete oil to keep the part flexible) are involved, and it is not contagious. The predisposing causes of this disease are many, and include the influence of constant dampness, the trouble occurring in horses grazing on swamps or working in soft muddy ground when the mud is allowed to accumulate and is not brushed out daily when dry. Digestive derangements and weak circulation are also predisposing causes. As the disease advances, fungi and micro-organisms of various kinds are found present, and though they tend to aggravate the trouble they have not so far been proved essential factors in causing the disease.

HEIFER WITH DRIPPING TEATS.

"SUBSCRIBER," Okoroire :—

I have a three-year-old heifer just calved, and its two back teats drip milk continuously. Would rubber bands prevent this ?

The Live-stock Division :—

There is no reliable preventive for the trouble you describe. Rubber bands would have to be so tight that the circulation would be interfered with, and this is undesirable.

REDWATER IN CATTLE.

"REDWATER," Mangamaire :—

Will you please let me know if feeding cows on swedes or turnips will cause redwater ? What are the recognized causes of this complaint, and the treatment for it ?

The Live-stock Division :—

Redwater in cattle is usually caused by too lavish and too constant feeding on roots. The usual symptom is a red colouration of the urine. The following treatment is recommended : Give the affected animal 1 lb. common salt in 4-oz. doses at four-hour intervals. Remove the animal from roots altogether for a time, placing it in a fresh pasture, and giving hay, bran mashes, linseed mashes, &c. After the bowels have moved freely from the salt drenches, give one of the following powders night and morning in a bottle of gruel : 2 drachms ferri carb. sacch., 1 oz. cinchona, 2 drachms gentian.

COWS RETURNING TO BULL.

F. HALL, Edendale :—

Can you give a reason for cows returning to the bull every three weeks for two or three periods and then getting in calf ? The cows were douched with Jeyes Fluid (1–60) after calving.

The Live-stock Division :—

Failure of conception in cows may be the result of a number of conditions, and in the absence of particulars or an examination of the animals it is difficult to say exactly what may be the cause in your case. As conception occurred after the second or third visit to the bull it is probable that at the earlier periods an undue acid condition of the genital passage has existed which spontaneously disappeared later. This condition has a devitalizing effect on the spermatozoa, and prevents conception by retarding their activity. An alkaline douche, made by dissolving 5 oz. of baking-soda in ½ gallon of water, used shortly before service, is in most cases followed by good results. Retention of the afterbirth, with the consequent septic discharge from the womb, will also account for failure to conceive, especially at the first or second period of oestrum. The fact that the bull may be at fault should not be overlooked. This frequently occurs where he is turned out with the herd, a state of temporary impotency being brought about by overwork.

ROARING IN HORSES.

R. S., Murchison :—

Would you kindly inform me if there is any cure for a roaring horse ? The symptoms in this case are as follows : After pulling for a distance the animal (a mare) nearly chokes ; the noise she makes is like that made by a Paradise duck, and seems to be in the windpipe, being worse at some times than at others. When spelled for a moment she makes a couple of belching noises and then ceases roaring.

The Live-stock Division :—

True " roaring " in horses is caused by paralysis of the left vocal cord in the larynx. The larynx is situated at the top of the windpipe between the two branches of the lower jaw. The noise is caused by the vibration of the vocal cord when the animal expires (breathes out). The only treatment for true roaring is an operation which is not always successful in removing the noise, nor is it always successful in restoring the animal's usefulness. It is needless to say that the operation can only be performed by a qualified veterinary surgeon who has a thorough knowledge of the anatomy, &c., of the region of the throat. Very often horses make a noise when pulling, and this noise is made when the animal inhales (breathes in) ; but the noise can also be heard on exhaling. This is caused by a badly fitting collar. The bottom of the collar presses on the windpipe, thereby constricting the lumen of the windpipe and causing a state of partial suffocation through the animal being unable to take in sufficient air to purify the blood. The same thing may happen when the throat-lash of the bridle is buckled up tight so that the windpipe or larynx is compressed. Again, if a horse's nose is drawn into the chest, as when a tight bearing-rein is used, the opening at the end of the windpipe through which the air passes is constricted and a noise is caused, while the horse, when pulling hard, partially suffocates and stops in his work. Another cause of horses making a noise is on account of growths, commonly polypi (narrow-based tumours) in the nose or back of the throat. The only treatment for these is a surgical removal by a veterinarian. If the noise is caused through pressure on the windpipe by the throat of the collar, a collar must be used which has room for the hand to be placed between the windpipe and the throat of the collar when the animal is pulling.

NOTICE.—An answer cannot be given to " L. J. S.," Poukawa, regarding grubs in loganberries, unless the full name is supplied. See general notice under heading of " Answers to Inquiries."

WEATHER RECORDS.

FEBRUARY, 1923.

THE following general summary and rainfall statistics are supplied to the *Journal* by the Director of the Dominion Meteorological Office (Mr. D. C. Bates) :—

The month opened with stormy weather, on account of the passing of a cyclone northward of the Dominion. Easterly gales and heavy rain were experienced in the north. Barometric pressure quickly recovered, but an extensive westerly low-pressure held sway over the Dominion between the 5th and 10th, with heavy rain in the west coast and southern districts, while warm and sultry conditions ruled in the east coast until the change took place with the wind backing to south-west on the 9th. This brought thunderstorms along the east coast. High pressure continued in the north from the 8th to the 13th, but from the 14th conditions were very unsettled everywhere, and changeable and showery weather prevailed until the end of the month. A cyclonic storm passed northward of the Dominion on the 28th.

Rainfall was mostly in excess in the west coast and southern districts of both Islands, but great diversities are apparent in the returns for the month. For instance, while Foxton was 74 per cent. above the average, Wellington was 54 per cent. below ; New Plymouth was 25 per cent. and Inglewood 12 per cent. below ; Whangamomona was 35 per cent. and Patea 57 per cent. above. Invercargill had over three times the average for the month; and Gore and Queenstown were each 123 per cent. above the mean for the month of former years. Rainfall was rather deficient on the east coast of the North Island and on some of the highlands in the South, but it was in excess on the highlands in the North.

RAINFALL FOR FEBRUARY, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	0·58	3	0·30	2·95
Russell	1·82	5	1·16	4·35
Auckland	3·84	12	1·82	2·97
Hamilton	2·94	11	1·15	2·85
Kawhia	3·48	9	1·10	2·40
New Plymouth	3·08	15	1·34	4·09
Inglewood	5·63	17	1·44	6·40
Whangamomona	5·60	19	1·02	4·14
Tairua, Thames	2·74	5	2·40	4·52
Tauranga	2·55	7	1·55	3·62
Maraehako Station, Opotiki ..	2·76	7	2·16	3·70
Gisborne	2·28	6	1·07	3·68
Taupo	3·66	6	1·54	2·81
Napier (Park Island)	2·78	7	0·62	3·02
Taihape	4·20	12	1·20	2·43
Masterton	3·54	12	1·40	2·71
Patea	3·66	13	0·82	2·33
Wanganui	3·19	4	1·50	2·49
Foxton	2·87	8	1·35	1·65
Wellington	1·47	14	0·58	3·23
South Island.				
Westport	6·46	20	0·98	4·37
Greymouth	7·29	21	1·21	6·13
Hokitika	9·62	20	2·30	7·29
Arthur's Pass	12·48	14	2·40	7·55
Okuru, Westland	14·76	18	2·84	7·92
Collingwood	3·82	11	1·24	5·63

RAINFALL FOR FEBRUARY, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Nelson	1·16	8	0·56	2·78
Spring Creek, Blenheim	1·56	7	0·45	2·30
Tophouse	4·14	14	0·88	4·50
Hanmer Springs	2·72	9	0·80	2·93
Waiau	2·56	10	0·84	2·55
Gore Bay	3·75	10	1·40	3·50
Christchurch	2·06	9	0·46	1·84
Timaru	2·02	16	0·34	1·89
Lambrook Station, Fairlie ..	1·01	7	0·32	1·95
Benmore Station, Omarama ..	0·86	11	0·16	1·23
Oamaru	3·20	9	1·08	1·72
Queenstown	3·92	12	0·66	1·76
Clyde	0·77	7	0·20	0·99
Dunedin	5·19	18	1·07	2·70
Gore	5·52	22	0·61	2·47
Invercargill	8·86	23	1·36	2·73

NOTE.—The following January rainfall figures were received too late for insertion in last month's *Journal*: Napier—Total fall, 8·10 in.; number of wet days, 17; maximum fall, 1·34 in.; Gore—Total fall, 3·50 in.; number of wet days, 17; maximum fall, 0·61 in.

TENURE OF LAND OCCUPIED IN NEW ZEALAND (excluding Boroughs): 1921–22.

Land District.	Freehold occupied by Owner.	Leased from Private Individuals.	Leased from Public Bodies.	Leased from Maoris.	Crown Leases and Licenses under various Tenures.	Total Area occupied.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
North Auckland	2,392,712	103,548	25,514	79,778	401,353	3,002,905
Auckland ..	2,829,700	137,816	47,297	455,675	1,026,828	4,497,316
Hawke's Bay ..	2,718,351	237,236	105,502	600,459	889,477	4,551,025
Taranaki ..	897,747	167,453	57,572	90,887	501,952	1,724,611
Wellington ..	3,267,988	378,750	83,220	450,423	755,601	4,935,982
Nelson ..	619,121	53,492	7,320	14,429	638,530	1,332,892
Marlborough ..	811,702	56,014	9,254	19,419	1,592,460	2,488,849
Westland ..	172,689	20,381	6,203	3,951	1,527,825	1,731,049
Canterbury ..	3,144,360	343,872	282,880	9,426	4,333,606	8,114,144
Otago ..	1,630,096	173,123	117,540	7,569	6,006,512	7,934,840
Southland ..	1,450,056	102,031	144,647	5,813	1,512,177	3,214,724
Totals, 1921–22	19,934,522	1,773,716	886,949	1,737,829	19,195,321	43,528,337
Totals, 1920–21	19,671,255	1,796,033	793,566	1,750,805	13,372,206	43,546,757

A farmers' course of instruction will be held at the Central Development Farm, Weraroa, from 30th April to 5th May next, on similar lines to those of last year's school. Applications for enrolment should be addressed to the Farm Manager, who will also supply any further information required. A moderate charge will be made for board. Early enrolment is advisable.

CUTTING OF CALIFORNIAN THISTLE.

In view of certain statements that Californian thistle is checked far more effectively when cut in flower than is the case with earlier cutting, the Department recently carried out tests on selected areas in Canterbury. Cutting at the respective stages was done last season, and the results, after the lapse of a year, have now been duly observed and recorded. Neither area gives any indication that late cutting results in the reduction of the thistles, there being no apparent difference between the late and early cut patches. Taking everything into consideration, including the obvious risk of allowing the thistle to flower, the Department cannot endorse the method of late cutting.

A SHEEP-FARMING HANDBOOK.

The latest of Messrs. Whitcombe and Tombs's series of Practical Handbooks to appear is "Sheep-farming in New Zealand," by William Perry, with contributions by other specialists. This is a branch of our agriculture whose treatment in simple book form has really been long overdue. The publishers of the present work have been well advised in their selection of principal author, Mr. Perry, the well-known studmaster of "Penrose," Wairarapa, being exceptionally well qualified for the part. The little volume is written primarily for the young farmer, whom it takes through the various phases of the subject, from choosing and equipping a sheep-farm, breeding, management, and feeding, to the preparation of the clip for sale. The book, however, will also be useful to a wider circle, and the discerning reader of experience will appreciate Mr. Perry's intimate touch in many places. The volume, which includes a number of photo illustrations of stud-sheep of various breeds, is bound in cloth, and is issued at the price of five shillings.

"CURE-ALLS" FOR LIVE-STOCK.

It is remarkable how gullible many persons are when approached by agents or canvassers of some preparation reputed to be a cure for almost any ill that animal flesh may be heir to. So-called "cure-alls" are constantly on the market, and are too often found on the shelf of the farmer, who, unfortunately, looks upon the purchase as a guarantee or insurance against any of the troubles to which his stock may become afflicted, and in time of trouble relies on such preparations—often to his future sorrow. Numerous cases have come under the Department's notice of very serious loss having occurred through too great reliance being placed on such preparations, and it is hoped that this note may serve as a warning to stockowners to look with suspicion on any preparation reputed by the canvasser to be a cure for this, that, and the other ill. A little thought should brand any such assertion as ridiculous, seeing that each trouble has its own peculiarity, and therefore its own particular treatment.

FORTHCOMING WINTER SHOWS.

Auckland A. and P. Association: Auckland, 1st to 8th May.
Waikato Winter Show Association: Hamilton, 29th May to 4th June.
Otago A. and P. Society: Dunedin, 5th to 8th June.
Taranaki Metropolitan Agricultural Society: New Plymouth, 6th to 9th June.
Manawatu A. and P. Association: Palmerston North, 19th to 22nd June.

(Agricultural and Pastoral Association secretaries are invited to supply dates and location of their shows.)